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PLANTAE PAPUANAE ARCHBOLDIANAE, XV*

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With one plate

IN CONTINUATION of our work on the Rubiaceae of this series, we again present a number of genera chosen not particularly as representing any special section or relationship in the family, but rather as a matter of convenience for study at the moment. We have studied *Hydnophytum* and *Myrmecodia* in conjunction with each other, since both have in common the peculiar tuber-like base. *Borreria* has the general habit of *Hedyotis* and is easily mistaken for it; the same is true of *Mitracarpus*. The genera considered in this paper are: *Dentella, Hedyotis, Ophiorrhiza, Argostemma, Airosperma, Hydnophytum, Myrmecodia, Nertera, Borreria,* and *Mitracarpus*.

RUBIACEAE (in part)

Dentella J. R. & G. Forster

Dentella Browniana Domin, Bibl. Bot. 22(Heft 89^{vii}): 1170 (616). 1929; H. K. Airy-Shaw, Kew Bull. 1934: 294. 1934.

BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5825,* January 1934, alt. 10 m., a clearing on a savanna (very small prostrate herb with minute white flowers). Queensland and Northern Territory.

Hedyotis Linnaeus

Hedyotis Schlechteri (Val.) comb. nov.
Oldenlandia Schlechteri Val. Bot. Jahrb. 60: 11. 1925.

Hedyotis Schlechteri var. **acuminata** (Val.) comb. nov.
Oldenlandia Schlechteri var. *acuminata* Val. Bot. Jahrb. 60: 12. 1925, Nova Guin. 14: 236. 1925.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12775,* Feb. 1939, alt. 1200 m., in dense undergrowth of rain-forest gully (ascending herb 50 cm. high).

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. 25: 183–205. 1944.

It has been a question whether to align this collection with the species or with the variety. The plant is slightly more pubescent than one of the collections cited in the original description of the species, and also the inflorescence is paniculately cymose.

Hedyotis Klossii Wernh. Trans. Linn. Soc. II. Bot. 9: 69. 1916.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13212,* March 1939, alt. 850 m., rain-forest, occasional on shady stream banks (fruticose herb 30–50 cm. high; flowers white). Previously known only from the type collection.

Hedyotis decipiens (Val.) comb. nov.

Oldenlandia decipiens Val. Bot. Jahrb. 60: 12. 1925.

A very distinct species, known only from the type collection from Northeast New Guinea.

Hedyotis idenburgensis sp. nov.

Herba parva, ± 10 cm. alta, ramosa subglabra; caulibus basi lignescentibus, diffusis, interdum procumbentibus, acute tetragonis, internodiis 3–5 mm. longis, glabris; foliis oblongo-lanceolatis, 7–10 mm. longis, 2–3 mm. latis, utrinque angustatis, apice acutis, margine in sicco planis vel revolutis, nervis lateralibus utrinsecus 2 vel 3 utrinque inconspicuis vel subobscuris; petiolo brevi vix 2 mm. longo; stipulis parvis lineari-lanceolatis puberulis; pedunculis axillaribus, singulis vel oppositis, unifloris vel interdum cymosis, circiter 2 cm. longis, bracteis oppositis linearibus circiter 3 mm. longis prope apicem instructis; floribus breviter pedicellatis; ovario urceolato; calycis lobis remotis, lineari-lanceolatis, 1.5 mm. longis, erectis demum leviter divergentibus; corolla 3 mm. longa, infundibulari, fauce pubescente, lobis lanceolatis vix 1.5 mm. longis, intus pubescentibus; staminibus in medio tubo insertis, filamentis 0.6 mm. longis, antheris 1 mm. longis; stigmate exserto verisimiliter capitato; capsulis depresso-globosis calyce persistente coronatis, (incl. calyce) 3.5 mm. longis, 2.5 mm. diametro, glabris; seminibus pluribus, obtuse angulatis, sub lente leviter reticulatis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13477* (TYPE), March 1939, alt. 850 m., on mossy flood-swept banks of a stream in rain-forest (flowers white).

This species has the general habit of *Hedyotis biflora* L. The flower, however, is distinctive; the anthers are long and narrow, and the lobes of the corolla are pubescent on the upper surface; as in *H. biflora,* the throat is pubescent within. The fruit also is distinctive; the valves of the capsule do not project as in *H. biflora,* so that the calyx-lobes are much more obvious in the fruit of this species. Sometimes there are minute linear appendages or glands between the calyx-lobes.

Hedyotis Valetoniana sp. nov.

Oldenlandia coprosmoidea Valeton in Lam, Natuurk. Tijdschr. Nederl.-Ind. 89: 72, 101, 133, 134. 1929, nomen; non *Hedyotis coprosmoides* Trimen (1894).

Planta prostrata glabra; caulibus tetragonis basi lignescentibus, internodiis brevibus 2–5 mm. longis; foliis confertis, lanceolatis vel oblongo-lanceolatis, 5–15 mm. longis, 3–4.5 mm. latis, apice acutis vel acuminatis, basi anguste obtusis, crassiusculis, nervis lateralibus utrinque obscuris;

petiolis brevissimis, 1–1.5 mm. longis; stipulis in vaginam brevem connatis margine pectinatis, setulis brevibus centrali longiore linearibus acutis; pedunculis axillaribus, 1.5–4 mm. longis, apice bibracteatis, bracteis circiter 4 mm. longis, foliiformibus; floribus supra bracteas subsessilibus; ovario subcampanulato, 1.5 mm. longo; calycis lobis 2.5 mm. longis, linearioblongis, acutis, tubo 1 mm. longo; corolla infundibulari, 6.5 mm. longa, tubo intus glabro, fauce tantum pilosulo, lobis 3 mm. longis intus pubescentibus; staminibus in apice tubi insertis, antheris 1.5 mm. longis, ellipticis, apiculatis; stylo glabro, 4 mm. longo; stigmate bilobato, lobis circiter 0.5 mm. longis; capsulis urceolatis calyce persistente coronatis, 3 mm. longis (incl. calyce 5 mm.), 2.5 mm. diametro; seminibus obtuse angulatis sub lente reticulatis.

Netherlands New Guinea: Lake Habbema, *Brass 9326* (type), Aug. 1938, alt. 3225 m., prostrate on sterile rocky knolls of grasslands (flowers lavender); near the foot of Doorman-top, *Lam 1610,* Oct. 1920, alt. 3250 m.

This species seems to be most closely related to *Oldenlandia nutans* Valeton; it differs in its prostrate very compact habit, fleshier leaves, and shorter corollas. Possibly a wider range of specimens would show gradations, but until such time as these are available it seems best to consider this a distinct species.

Hedyotis tenelliflora Bl. var. **papuana** (Val.) comb. nov.

Oldenlandia tenelliflora var. *papuana* Val. Nova Guin. 8: 453. 1911, ibid. 14: 234, *pl. 22, fig. A, 1–5.* 1925.

Netherlands New Guinea: Balim River, *Brass 11628,* Dec. 1938, alt. 1600 m., deforested slopes, common grass associate on sandy soil (flowers white). British New Guinea: Mafulu, *Brass 5152,* Oct. 1933, alt. 1250 m., small roadside weed on grassy spurs; Wuroi, Oriomo River, *Brass 5830,* rare on savanna clearing. Not previously reported from Papua.

Hedyotis vestita R. Br. in G. Don, Gen. Syst. 3: 526. 1834.

Spermacoce costata Roxb. Fl. Ind. 1: 376. 1820.

Hedyotis costata (Roxb.) Kurz, Jour. As. Soc. Bengal 45(2): 135. 1876; Merr. Enum. Philip. Fl. Plants 3: 497. 1923; non *H. costata* R. Br. (1834).

Oldenlandia costata (Roxb.) Koorders, Exkurs.-Fl. Java 3: 240. 1912.

Netherlands New Guinea: Nasau region, *Docters van Leeuwen 10752,* Oct. 1926, alt. 700 m.

As far as we know, this is the first record of the species from New Guinea.

Hedyotis pubescens (Val.) comb. nov.

Oldenlandia pubescens Val. Nova Guin. 8: 439. 1911, ibid. 14: 233. 1925, Bot. Jahrb. 60: 10. 1925.

British New Guinea: Dieni, Ononge Road, *Brass 3934,* May 1933, alt. 500 m., in shelter of roadside undergrowth; Lake Daviumbu, Middle Fly River, *Brass 7621,* in a bamboo grove. Herb 30–40 cm. tall; flowers white.

The only difference we find between Valeton's description and the specimens cited is a ring of hairs or a hairiness on the inside of the corolla just at the base of the filaments; possibly in full-blown flowers this would be just below the throat or in it. The species seems to be common, having been reported from both Netherlands New Guinea and Northeast New Guinea.

Hedyotis congesta R. Br. in G. Don, Gen. Syst. 3: 526. 1834.

Metabolos rigidus Bl. Bijdr. 992. 1826.

Hedyotis rigida (Bl.) Miq. Fl. Ind. Bat. 2: 181. 1857, non Walp. (1852).
Oldenlandia rigida (Bl.) Val. Nova Guin. 8: 438. 1911.

Hedyotis congesta R. Br. var. **longifolia** (Val.) comb. nov.
Oldenlandia rigida var. *longifolia* Val. Nova Guin. 8: 438. 1911, ibid. 14: 234. 1925.

NETHERLANDS NEW GUINEA: East slopes of Cyclops Mountains, *Brass 8926,* June 1938, alt. 450 m., occasional in forest undergrowth; 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13626,* March 1939, alt. 850 m., occasional in rain-forest (shrub 1 m. high; branches weak, spreading, fruit white). BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5691,* plentiful about borders of rain-forest and in small forest clumps on savannas (shrub about 1.5 m. tall with slender spreading branches; leaves glaucous above, pale and scaberulous beneath; flowers lavender-colored; soft, white, uneven fruit 5–7 mm. diameter); Tarara, Wassi Kussa River, *Brass 8426,* abundant in rain-forest and savanna-forest contact areas (herbaceous shrub 1–1.5 m. high; leaves glaucous above; flowers bluish white).

Valeton mentions the very characteristic white fruit; and Ridley believes the fleshy white fruit is unique in the genus.

Hedyotis Lapeyrousii DC. Prodr. 4: 420. 1830; Rich. Voy. Astrol. Bot. 2: 64. *pl. 23.* 1834.
Hedyotis auricularia var. *melanesica* Fosb. Bull. Torr. Bot. Cl. 67: 419. 1940.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13762,* April, alt. 60 m., in gravelly bed of foothill stream, rare. BRITISH NEW GUINEA: Daru Island, *Brass 6435,* common in rain-forest, gregarious in patches; Palmer River, 1 mile above junction Black River, *Brass 6941,* plentiful on a riverbank landslip; Lake Daviumbu, Middle Fly River, *Brass 7772,* massed in old clearings. SOLOMON ISLANDS: San Cristoval: Waimamura, *Brass 2621,* pathways and small clearings in lowland rain-forests, common.

This material appears to be identical with that from the New Hebrides as illustrated in the above-cited plate, and also with that described by Fosberg as a variety of *H. auricularia* L. Unfortunately we have no authentic material of the latter species for comparison; the collections which have been assigned to it have definitely smaller flowers than the Papuasian material. This also seems to be very close to, if not identical with, the material passing in New Guinea as the Linnaean species. The original was collected in Ceylon.

Hedyotis radicans (DC.) Miq. Fl. Ind. Bat. 2: 181. 1857; Merr. Enum. Philip. Fl. Pl. 3: 499. 1923.
Metabolos radicans DC. Prodr. 4: 435. 1830.
Oldenlandia radicans O. Kuntze, Rev. Gen. 1: 292. 1891.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3974,* May 1933, alt. 500 m., plentiful in a bamboo plantation (ascending herb with white flowers); Tarara, Wassi Kussa River, *Brass 8503,* rain-forest ground cover, associated with *Scleria lithosperma* Sw. in broken shade.

These collections seem to agree reasonably well with the Philippine material of this species at hand.

Hedyotis novoguineensis sp. nov.

Herba adscendens vel erecta vel decumbens, 30–50 cm. alta, basi perennis; caulibus argute quadrangulatis, minute pilosulis vel glabratis, 1–2 mm. crassis, foliosis, sparsim ramosis vel simplicibus, internodiis 1–6 cm. longis; foliis lanceolatis vel ellipticis, utrinque aequaliter angustatis, apice acutis, basi acutis vel cuneatis, margine in sicco interdum revolutis, 1.5–3.5(–4)

cm. longis, 0.5–1(–2) cm. latis, supra glabris vel sparsim pilosulis, subtus hirtellis, nervis lateralibus utrinsecus 3, supra obscuris, subtus inconspicuis; petiolo 2–5 mm. longo, pubescente; stipulis ovatis, hirtellis, apice subulatis, superioribus margine subpectinatis vel glandulosis; floribus glomerulatis, axillaribus, densis, subsessilibus vel glomerulo pedunculato, bracteatis, bracteis ovario brevioribus; ovario obconico, vix 1.5 mm. longo, piloso; calycis lobis 1.5 mm. longis, lanceolatis, acutis, recurvis, pilosis et ciliatis; corollae tubo 2.5 mm. longo, extus glabro, fauce dilatato, intus pilosulo, lobis circiter 1 mm. longis, ovatis, extus sparsim intus densiuscule pilosulis; staminibus in fauce tubi insertis, antheris paulo exsertis; stylo glabro, 3 mm. longo; stigmate exserto; capsulis globosis, vix 2 mm. diametro, calycis lobis persistentibus recurvis coronatis, septicidaliter dehiscentibus; seminibus angulatis reticulatis, nigris.

BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5831* (TYPE), Jan. 1934, alt. 10 m., small savanna clearing (plant with pale purple flowers); Gaima, Lower Fly River (east bank), *Brass 8339*, Nov. 1936, scrambling amongst grass in dense savanna-forest (flowers white).

This species has the general habit of *Hedyotis stipulata* R. Br., but the calyx-lobes are narrower, pilose, and ciliate, and in fruit much less conspicuous than in *H. stipulata* R. Br.

Hedyotis glomerulata sp. nov.

Herba erecta, circiter 50 cm. alta glabra, basi probabiliter perennis; caulibus argute quadrangulatis, circiter 2 mm. crassis, foliosis, internodiis 2.5–4.5 cm. longis; foliis ellipticis, 2–3.5 cm. longis, 0.8–1.5 cm. latis, obtuse acutis, basi paulo angustatis, margine praecipue versus basim revolutis, nervis lateralibus utrinsecus 3, supra manifestis, subtus subprominulis, supra olivaceis, subtus pallidioribus; stipulis late ovatis breviter vaginantibus, apice breviter subulatis, superioribus margine pectinatis vel glandulosis; petiolo brevissimo vel foliis subsessilibus; floribus glomerulatis, axillaribus, densis, sessilibus, basi bracteatis; ovario obconico, 1.5 mm. longo glabro; calycis lobis oblongo-lanceolatis, ciliatis, 2 mm. longis; corollae tubo 2.5 mm. longo, fauce pubescente, lobis ovatis obtusiusculis ± 1 mm. longis, intus pubescentibus; antheris in apice tubi insertis, inclusis; stylo glabro, 2.5 mm. longo; stigmate subexserto; capsulis elongato-globosis, circiter 2 mm. diametro, calycis lobis recurvis coronatis, tarde septicidaliter dehiscentibus; seminibus pluribus angulatis reticulatis nigris.

BRITISH NEW GUINEA: Mafulu, *Brass 5315* (TYPE), Oct. 1933, alt. 1250 m., common amongst tall grass of deforested spurs (flowers white).

This species is very closely related to *Hedyotis novoguineensis*. It may be distinguished by its generally glabrous character; the calyx-lobes are ovate and ciliate, rather than lanceolate, and are slightly larger than in *H. novoguineensis*, and the capsules are a little more elongate and glabrous.

Hedyotis trichoclada sp. nov.

Herba parva perennis repens pubescens; caulibus dense pubescentibus vel breviter pilosis, internodiis 2–5 mm. longis; foliis 2.5–6 mm. longis, 1–3 mm. latis, ovatis, apice acutis vel obtusiusculis, basi obtusis, margine in sicco interdum revolutis, supra glabris vel prope marginem sparsim

pilosis, subtus consperse pilosis vel glabris, margine ciliatis vel glabris, nervis lateralibus utrinsecus plerumque 2, supra inconspicuis, subtus manifestis; petiolo 1 mm. longo pubescente; stipulis connatis minutis obtuse ovatis, margine glandulosis; floribus solitariis axillaribus, pedunculis 0.5 mm. longis; ovario 1 mm. longo, campanulato, dense patenti-piloso; calycis lobis lineari-lanceolatis, vix 1.5 mm. longis, sinu lato, glandulis interjectis; corollae tubo 2.5–3 mm. longo utrinque glabro, lobis ovatis, 1 mm. longis, intus puberulis; staminibus in apice tubi insertis, antheris exsertis; stylo vix 1.5 mm. longo glabro; stigmate bilobo, lobis linearibus, 1 mm. longis; fructibus globosis, circiter 2 mm. diametro, calycis lobis coronatis; seminibus numerosis, angulatis, reticulatis, brunnescentibus.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9197* (TYPE), Aug. 1938, alt. 3225 m., matted on sandy banks of grassland stream (flowers white); 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9752,* Sept. 1938, alt. 3400 m., in wet grassy valley (flowers white, sometimes faintly violet, anthers dark violet).

Although the habit of this plant suggests *Anotis* DC., it has all the characters of *Hedyotis* L. There are about 25 to 30 seeds in the fruit.

Hedyotis nana sp. nov.

Herba parva perennis repens pubescens; caulibus implicatis dense patenti-pubescentibus, 1 mm. diametro, internodiis 2–5 mm. longis; foliis usque 4 mm. longis, 2.5 mm. latis, elliptico-ovatis vel subrotundatis, apice obtusiusculis, basi rotundato-cuneatis, crassiusculis, supra convexis, sub lente minutissime et profuse papillosis, glabris vel consperse pilosis, subtus concavis patenti-pilosis et cystolithis praeditis, nervis lateralibus utrinsecus 2, utrinque obscuris; petiolo 1 mm. longo, patenti-pubescente; stipulis inconspicuis, connatis, margine glandulosis; floribus solitariis, axillaribus, subsessilibus; ovario vix 1.5 mm. longo, dense patenti-piloso; calycis lobis ellipticis utrinque angustatis, acutiusculis, extus patenti-pilosis, intus minutissime papillosis, sinu lato, glandulis interjectis parvis; corolla in alabastro versus apicem sparsim pilosa; corollae tubo circiter 2 mm. longo, lobis 1 mm. longis, obtuse triangularibus; staminibus in apice tubi insertis; antheris subexsertis; stylo glabro brevi; stigmate bilobato; fructibus subglobosis, calycis lobis coronatis; seminibus numerosis, angulatis, reticulatis, nigris.

BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4691* (TYPE), Aug. 1933, alt. 2840 m., very plentiful in small flat masses on burnt grasslands (plant has strong odor of turnips; flowers white); Mount Albert Edward, southwestern slopes, *Brass 4394,* July 1933, alt. 3680 m., prostrate on wet bank of a small grassland stream (flowers pink).

Hedyotis nana and *H. trichoclada* are closely allied, the flowers differing chiefly in the pubescence and texture of the calyx-lobes; in the former there is a sparse pilosity on the upper part of the corolla. The species are readily distinguished by the leaves; although in both species these are very small, in *H. nana* they appear to be thicker in texture, are strongly concavo-convex, and on the upper surface under a good lens are very minutely but densely papillate; in *H. trichoclada* they are thinner in texture and lack the papillate surface of the other species. They are readily distinguished from the other species of *Hedyotis* in this region by their prostrate habit and minute leaves.

Ophiorrhiza Linnaeus

Ophiorrhiza sylvatica sp. nov.

Herba ± 30 cm. alta; caulibus decumbentibus nodis inferioribus radicantibus, novellis crispe pubescentibus, inconspicue angulatis vel compressis; foliis plerumque subaequalibus, lanceolatis, pergamaceis, in sicco supra olivaceis, subtus pallidioribus, apice sensim acutis, basi rotundato-cuneatis vel acutis, 2.5–6 cm. longis, 0.7–1.6 cm. latis, nervis lateralibus utrinsecus 8–10 supra inconspicuis, subtus prominulis, reticulo laxo; petiolo 5–10 mm. longo; stipulis filiformibus caducis, circiter 3 mm. longis; inflorescentiis terminalibus vel in axillis superioribus, pedunculatis, pedunculo 5–10 mm. longo, glabro; ramis subdivaricatis basi bracteatis, bracteis parvis filiformibus; floribus glabris breviter pedicellatis, subsecundis, minute bracteatis, ad anthesin 6 mm. longis; pedicellis 0.5–1 mm. longis; calyce cum ovario 1.5 mm. longo, dentibus vix 0.5 mm. longis; corollae tubo 3 mm. longo, intus circiter medio adpresse piloso (pilis erectis), sursum puberulo vel subglabro, lobis ovatis circiter 1 mm. longis prope apicem dorso calcaribus falciformibus 1 mm. longis praeditis; flore longistylo: antheris subtus medio tubo, filamentis brevissimis, vix 0.5 mm. longis, stylo glabro, subexserto; stigmate bilobato; flore brevistylo: antheris subexsertis, 1.5 mm. longis, linearibus, filamentis 2 mm. longis subtus medio insertis; stylo 2 mm. longo, glabro; capsulis anguste transverse oblongis, circiter 5 mm. latis, vix 1.5 mm. altis secus ramos subsecundis, breviter pedicellatis.

British New Guinea: Fly River, 528 mile Camp, *Brass 6765* (type), May 1936, alt. 80 m., plentiful amongst rotting wood and leaves in openings made by fallen trees.

This species is most closely related to *Ophiorrhiza palustris* Val.; it differs in having smaller subequal leaves, glabrous inflorescence, and smaller fruits. It also grows in a different habitat. The plant has both long- and short-styled flowers; in the long-styled flowers the stamens are on very short filaments very close to the base of the tube, the tips of the anthers just reaching the pilose ring approximately in the middle of the corolla-tube on the inside; in the short-styled flowers, the anthers are partly exserted, the filaments being attached at the pilose ring. A rather unusual combination of the characters is the glabrous peduncle and inflorescence developing at the apex of a branchlet covered by crisp short brown hairs; the corolla is conspicuously corniculate.

Ophiorrhiza longisepala sp. nov.

Herba ± 30 cm. alta; caulibus adscendentibus vel suberectis, versus apicem crispe pubescentibus, subrotundatis, internodiis 3–5 cm. longis vel versus apicem brevioribus; foliis ad nodos inaequalibus, majoribus 8–12 cm. longis, 2.7–4 cm. latis, minoribus 2–6.5 cm. longis, 0.7–2.3 cm. latis, ellipticis (interdum leviter ovatis), utrinque angustatis, apice acuminatis, basi acutis, tenuiter pergamaceis, in sicco olivaceis glabris, subtus pallidioribus, costa et nervis et venis minute pubescentibus; nervis lateralibus utrinsecus 7–12, supra manifestis, subtus prominulis, venis interspersis inconspicuis; petiolo 1–2.5 cm. longo, minute pubescente; stipulis filiformibus usque 9 mm. longis; inflorescentiis terminalibus subcorymbosis, circiter 2 cm. latis in fructu, pedunculatis, pedunculo 4(–10 in fructu) mm.

longo, crispe pubescente, ramosis, ramis 3 vel 4, brevibus, paucifloris; bracteis filiformibus; floribus pedicellatis, pedicello 1–2(–4 in fructu) mm. longo; ovario minute pubescente, obconico-urceolato, 1.5 mm. alto; calycis lobis lineari-filiformibus 2–2.5 mm. longis, in sicco apice recurvis; corolla in alabastro oblonga, parte inferiore puberula, tubo intus glabro, fauce barbato, lobis cristatis, intus papilloso-puberulis; staminibus circiter medio tubo insertis, antheris inclusis; stylo glabro, stigmaticis lobis linearibus acutis; capsulis 7 mm. latis, 3 mm. altis, calycis lobis persistentibus coronatis, puberulis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12251* (TYPE), January 1939, alt. 1750 m., plentiful in rain-forest gullies.

This collection at once suggested *Ophiorrhiza rivularis* Val. on account of the very long almost filiform calyx-lobes; however, it is less pubescent; the leaves are larger with about twice as many lateral veins; the inflorescences are pedunculate rather than sessile; the throat of the corolla is barbate rather than glabrous, and the anthers are included. It is very readily distinguished by the calyx-lobes, which are persistent in fruit.

Ophiorrhiza nerteriformis sp. nov.

Herba prostrata nodis radicans; caulibus subtetragonis vel compressis, novellis pubescentibus, internodiis 5–10 mm. longis; foliis parvis, 5–7 mm. longis, 3–6.5 mm. latis, leviter inaequalibus vel aequalibus, ovatis, acutis vel acutiusculis, basi rotundatis deinde brevissime cuneatis, margine interdum crispulis, supra glabris olivaceis, subtus pallidioribus, costa nervisque pubescentibus, nervis lateralibus oblique patentibus arcuatis, utrinsecus 4 vel 5 supra manifestis, subtus prominulis; reticulo subtus manifesto; petiolo circiter longitudinem folii aequante, pubescente; stipulis filiformibus 1–1.5 mm. longis; inflorescentiis saepissime terminalibus, pedunculo saepe trifloro, usque 1 cm. longo, pubescente, apice lineari-bracteato; floribus pedicellatis, pedicellis vix 2 mm. longis; flore extus paulo puberulo; ovario obconico, vix 1 mm. longo; calycis lobis vix 1 mm. longis, lineari-lanceolatis; corolla in alabastro 5-costata, costa cristata, corollae tubo 3 mm. longo, intus in dimidio superiore piloso, lobis 1.5 mm. longis, cristatis, crista apice latiore; staminibus in parte inferiore insertis, filamentis longis, antheris exsertis; stylo brevi; capsulis 3.5 mm. latis, 1.5 mm. altis, minute pubescentibus.

BRITISH NEW GUINEA: Kurandi, Eastern Division, *Brass 1445* (TYPE), May 1925, prostrate herb in dense masses on forest floor.

This species seems to approach the description of *Ophiorrhiza tenelliflora* Val., but the latter is a larger plant in all its parts, the petals are corniculate, and the stamens are inserted at the base of the corolla and included. In *O. nerteriformis* the flower-bud is five-crested, the crests narrowing down along the five ribs of the bud, the stamens are exserted, and although the filaments may extend to the base of the corolla, they are apparently free only about two-thirds of the length of the corolla-tube. This specimen was previously reported as *Nertera depressa* var. *papuana* Val., in a genus to which it could not possibly belong.

Ophiorrhiza tafaensis sp. nov.

Planta 20–40 cm. alta; caulibus ascendentibus, novellis crispe pubes-

centibus, pauciramosis, subteretibus vel leviter angulatis, internodiis 2–7 cm. longis, inferioribus superioribus longioribus; foliis leviter inaequalibus, 2.5–11 cm. longis, 1.3–3 cm. latis, ellipticis interdum lanceolatis, basi rotundatis et abrupte cuneatis, apice acutis, in sicco supra atro-fuscis glabris, subtus pallidioribus fere cinereis, costa et nervis minute pubescentibus, nervis lateralibus utrinsecus 7–12 supra manifestis, subtus perspicuis, venis interspersis; petiolo crispe puberulo, 4–10 mm. longo; stipulis filiformibus, caducis; inflorescentiis terminalibus et axillaribus, pedunculatis, pedunculo 5–10 mm. longo in fructu usque 2 cm., ramosis, ramis 2 vel 3, paucifloris; floribus breviter pedicellatis; ovario 1.5 mm. longo obconico-urceolato, puberulo; calycis lobis lanceolatis, acutis, vix 1 mm. longis; corolla in alabastro 5-costata, costa anguste alato-cristata, tubo 3.5 mm. longo, extus consperse puberulo, intus prope medio inter antheras piloso, lobis circiter 2 mm. longis intus papilloso-puberulis, extus anguste cristatis; antheris linearibus, 1.5 mm. longis, circiter medio tubo insertis; stylo brevi; stigmate bilobato, lobis linearibus stylum subaequantibus; capsulis 9 mm. latis, 3 mm. altis, puberulis.

British New Guinea: East Mount Tafa, *Brass 4133a*, May 1933, alt. 2100 m., small roadside herb, fairly common (plant purple-tinged; flowers white); Mavi, Mount Tafa Range, *Brass 4985* (type), Sept. 1933, alt. 2225 m., plentiful on shaded road-banks (fleshy small herb with wrinkled leaves, very pale beneath; stems, petioles, and peduncles red; flowers very pale pink).

In the compact inflorescence, the size of the leaves, and probably the general habit of the plant, this species suggests *Ophiorrhiza montisschraderi* Val.; it may be readily distinguished from the latter by floral characters. The corolla-lobes of the latter species are corniculate and the throat is densely barbate; in *O. tafaensis* the corolla-lobes are crested, the crests extending down along the middle of the lobes like very narrow wings, and the corolla has a band of hairs below the throat immediately back of the anthers.

Ophiorrhiza callianiha sp. nov.

Planta usque 1 m. alta; ramulis glabris, internodiis 1.5–6 cm. longis; foliis ad nodos subaequalibus vel leviter inaequalibus, 7.5–17 cm. longis, 2.5–6.5 cm. latis, chartaceis, ellipticis vel lanceolatis, apice acuminatis, acumine 1–1.5 cm. longo, basi cuneatis vel rotundato-decurrentibus, supra atrofuscis, glabris, subtus pallidioribus, nervis puberulis, nervis lateralibus utrinsecus 10–13 patenti-adscendentibus arcuatis utrinque prominulis; petiolo 1–2.5 cm. longo; stipulis brevibus filiformibus caducis; inflorescentiis terminalibus longe pedunculatis, pedunculo 4.5(–8 in fructu) cm. longo, glabro, 6 cm. latis, 3 cm. altis, ramosis, ramis 3 vel 4 plerumque dichotomis paucifloris; floribus primum laxe fascicu'atis deinde subsecundis; ovario fere 2 mm. longo, puberulo; calycis lobis ovatis, acutiusculis, 1 mm. longis; corolla in alabastro tubulata vel sub anthesin apice (lobis) ovali, extus glabra, apice 5-costato, costa crassa, anguste cristata; corollae tubo 1.2–1.4 cm. longo, fauce villoso, lobis 4 mm. longis, oblongo-ovatis, intus glabris, extus cristatis; staminibus 3–4 mm. supra basim tubi insertis, filamentis liberis 1 mm., antheris 3 mm. longis, linearibus; stylo glabro, 1.4–1.6 cm. longo; stigmaticis lobis ovatis; capsulis glabris, 8–9 mm. latis, 4 mm. altis.

Solomon Islands: Bougainville: Kugumaru, Buin, *Kajewski 1957* (type),

July 1930, alt. 150 m., rain-forest (small roadside plant up to 1 m. tall; flowers white, very showy).

The distinctive feature of this species is the rather large flower with long corolla-tube, slightly crested lobes, villous throat, and glabrous style; nevertheless, it does not compare in size with the flower of some of the Polynesian and Melanesian species.

Ophiorrhiza solomonensis sp. nov.

Planta usque 1.5 m. alta; ramulis ultimis glabris, compressis; foliis ad nodos leviter inaequalibus, 11–17 cm. longis, 5–6.5 cm. latis, tenuiter chartaceis, ellipticis, apice subabrupte acuminatis, basi obtusis vel rotundato-cuneatis, in sicco utrinque olivaceo-viridescentibus, glabris, nervis lateralibus utrinsecus circiter 12 utrinque perspicuis; petiolo 1–3.5 cm. longo, glabro; stipulis cito caducis; inflorescentiis terminalibus pedunculatis, pedunculo 2–6 cm. longo, puberulo, ramosis, ramis 3–5 vulgo dichotomis, paucifloris; floribus breviter pedicellatis, pedicello 1–2 mm. longo; ovario vix 1 mm. longo, puberulo; calycis lobis 0.5 mm. longis, lanceolatis; corolla in alabastro clavata, 1 cm. longa, apice leviter carinata; corollae tubo glabro, 6 mm. longo, fauce ± villoso, lobis 5 mm. longis, lanceolato-ellipticis; staminibus circiter tubo medio insertis, filamentis 4 mm. longis, antheris 2 mm. longis, exsertis; stylo brevi, 2 mm. longo, glabro; stigmate bifido, lobis linearibus 2 mm. longis, inclusis; capsulis non visis.

SOLOMON ISLANDS: Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2656* (TYPE), June 1931, alt. 1200 m., rain-forest (a shrub up to 1.5 m. high, with white flowers).

In this species the texture of the corolla is thinner and more delicate than in any of the others of the genus which we have examined, and the lobes are about as long as the tube. In the dried specimen the leaves also are very thin and brittle; they tend to be larger and are glabrous, although under high magnification there are minute granules or cystoliths(?) scattered over the lower surface.

Ophiorrhiza decipiens sp. nov.

Planta usque 50 cm. alta, ± erecta; caulibus suberectis, novellis dense puberulis, compressis, internodiis 2–4.5 cm. longis; foliis ad nodos inaequalibus, majoribus 7–11 cm. longis, 3–4.5 cm. latis, minoribus 3–6 cm. longis, 1–2.5 cm. latis, anguste ellipticis vel lanceolatis, apice acutis, basi cuneatis, tenuiter pergamaceis, in sicco supra olivaceis glabris, subtus pallide brunnescentibus, costa nervisque puberulis; nervis lateralibus utrinsecus 6–10, supra manifestis, subtus perspicuis, venis et reticulo laxo manifestis; petiolo 5–20 mm. longo, puberulo; stipulis singulis vel bifidis, filiformibus, 7 mm. longis; inflorescentiis saepissime terminalibus totis dense puberulis, 3 cm. latis, cum pedunculo 4 cm. longis, ramosis, ramis ultimis 2- vel 3-floris; floribus breviter pedicellatis, subsecundis; ovario circiter 1 mm. longo; calycis lobis ovatis, 0.5 mm. longis; corollae lobis 1.5–2 mm. longis, breviter corniculatis, cornu 1.5 mm. longo, trigono; flore longistylo: corollae tubo circiter 4 mm. longo, fauce dense barbato; staminibus circiter medio tubo insertis, antheris inclusis, 1.5 mm. longis; stylo 4 mm. longo, parce piloso; flore brevistylo: corollae tubo 4 mm. longo, intus 1 mm. supra basim sursum piloso, fauce non barbato; staminibus circiter medio tubo insertis, antheris exsertis; stylo 2 mm. longo, sparsim piloso; capsulis 5 mm. latis, 2 mm. altis, puberulis.

British New Guinea: Dieni, Ononge Road, *Brass 3877* (type in Herb. New York Bot. Gard.), April 1933, alt. 500 m., rain-forest floor, common (fleshy undershrub or herb up to 50 cm. high; stem and petioles purplish; flowers white).

Among the species of this genus already described, this one most closely approaches *Ophiorrhiza Lauterbachii* Val.; in *O. decipiens,* however, the stipules are not subpersistent, the plant is for the most part covered with a very short close pubescence, and the relative length of the corolla-tube and its lobes is different, in our species the lobes being about one half the length of the tube, while in Valeton's species they are longer than the corolla-tube. The two plants we have at hand show heterostyly, although the difference in the pubescence within the corolla-tube in the two types of flowers was not anticipated; the long-styled flower has a densely villous throat, the other has a diffuse pilosity extending down the tube.

Ophiorrhiza straminea sp. nov.

Planta usque 1.5 m. alta; ramulis glabris, compressis vel obtuse angulatis, internodiis 1.5–7 cm. longis; foliis ad nodos leviter inaequalibus, majoribus 11–17 cm. longis, 3.5–5.5 cm. latis, minoribus 5.5–10 cm. longis, 3–4 cm. latis, tenuiter chartaceis, utrinque glabris, in sicco supra olivaceis, subtus leviter pallidioribus, nervis lateralibus utrinsecus 11–17 utrinque prominulis, reticulo laxo subtus manifesto; petiolo 1–3 cm. longo; stipulis filiformibus, caducis; inflorescentiis terminalibus et axillaribus, pedunculatis, pedunculo 1.5–2 cm. longo, glabro vel puberulo, ramosis, ramis 3 vel 4 plerumque dichotomis, puberulis, circiter 6- vel 7-floris; floribus subsecundis; alabastro truncato, apice 5-plicato, medio sursum leviter dilatato; ovario dense puberulo, campanulato, 1.5 mm. longo; corolla glabra, tubo 4 mm. longo, ostio dense villoso, lobis 2.5 mm. longis, basi 1.5 mm. latis, acutiusculis, intus papilloso-puberulis, extus sub apice trigono-corniculatis; staminibus 1 mm. supra basim tubi insertis, antheris circiter 2 mm. longis; stylo 6 mm. longo, sparsim pilosulo; capsulis glabris, 6 mm. latis, 2 mm. altis.

Solomon Islands: Bougainville: Kupei Gold Field, *Kajewski 1729* (type), April 1930, alt. 1000 m., rain-forest (plant up to 1.5 m. tall; flowers cream).

This species perhaps is closest to *Ophiorrhiza Mungos* Linn. as described by Valeton in Ic. Bogor. 4: *t. 385.* 1914; it differs in being a more nearly glabrous plant, with shorter peduncles, and with corolla-lobes having a small trigonous crest or appendage.

Ophiorrhiza leptophylla sp. nov.

Planta usque 1.5 m. alta, herbacea, ramosa; ramulis crispe pubescentibus, compressis vel subangulatis; foliis 5–16 cm. longis, 2.5–7 cm. latis, tenuiter pergamaceis, ovatis vel ellipticis, apice subabrupte vel sensim acuminatis, basi rotundatis deinde breviter cuneatis, subaequalibus, supra consperse scabridulis vel crispe pubescentibus, subtus costa nervisque crispe pubescentibus, novellis lamina etiam crispe pubescente, margine interdum ciliatis, nervis lateralibus utrinsecus 9–16 utrinque prominulis, reticulo subconferto, distincte manifesto; petiolo 5 mm.(sub inflorescentia) — 5.5 cm. longo, crispe pubescente; stipulis anguste triangularibus, apice filiformibus, crispe pubescentibus; inflorescentiis 1 cm. altis, 1.5–2 cm. latis, saepissime terminalibus, interdum axillaribus, breviter pedunculatis, pedunculo 5–8 mm. longo, ramosis, ramis 3–5 subfastigiatis, non divaricatis, floribus con-

fertis, pedicellis brevissimis; ovario subgloboso, 1 mm. longo, dense pubescente; calycis lobis anguste lanceolatis acutis, vix 1.5 mm. longis; corolla in alabastro tantum 6 mm. longa, probabiliter infundibuliformi, oblanceolata, extus dense et crispe pilosula, intus 1.5 mm. supra basim (sursum 2 mm.) villosa (probabiliter faucem includente), apice 5-corniculata, calcare 0.8 mm. longo; staminibus in fauce insertis, antheris 1.5 mm. longis; stylo circiter 2 mm. longo, stigmate bilobato, lobis linearibus, 1.5 mm. longis; capsulis 5 mm. latis, 2 mm. longis, crispe pubescentibus.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2035* (TYPE), Aug. 1930, alt. 850 m., common, growing close to the water (plant very fleshy, up to 1.5 m. tall; petals crystal white, young buds covered with green hair; fruit green).

Ophiorrhiza leptophylla has the same general habit as *O. trichoclada,* but it is readily distinguished by the thinner somewhat scabrid leaves, as well as by the short-peduncled and compact inflorescences and infructescences; the fruits are much more pubescent, and the stipules are not bifid.

Ophiorrhiza Valetonii nom. nov.

Ophiorrhiza nervosa Valeton, Bot. Jahrb. 60: 33. 1925, non Ridley (1912).

Known only from the Kani Mountains, Northeast New Guinea.

Ophiorrhiza trichoclada sp. nov.

Planta usque 1.5 m. alta, ramosa; ramulis crispe pubescentibus, internodiis superioribus 3–10 cm. longis, subtetragonis vel compressis; foliis 7–12 cm. longis, 3.5–7 cm. latis, pergamaceis, ellipticis vel late ellipticis, apice subabrupte acuminatis, basi rotundatis deinde brevissime cuneatis, subaequalibus, supra atro-fuscis, glabris vel consperse minute pubescentibus, subtus brunnescentibus, costa nervisque pubescentibus, nervis lateralibus utrinsecus 13–15 utrinque subprominulis, reticulo laxo, manifesto; petiolo 0.8 mm. (sub inflorescentia) — 3 cm longo, pubescente; stipulis 5 mm. longis, profunde bifidis, apice filiformibus, ± pubescentibus; inflorescentiis 4.5–5.5 cm. latis, 2–3 cm. altis, terminalibus, longe pedunculatis, pedunculo 5(ad anthesin) — 9 cm.(in fructu) longo, crispe et dense pubescente, ramosis, ramis ± divaricatis, subverticillatis, iterum ramosis, in ultimis ramulis floribus subsecundis, breviter pedicellatis, pedicello 1 mm. longo, minute bracteatis; tota flore extus minute et crispe pubescente; ovario obconico 1 mm. longo; calycis lobis 1 mm. longis, lineari-lanceolatis; corolla in alabastro late clavata, carinata, carinis irregulariter dentatis; corollae tubo 4.5 mm. longo, fauce dense villoso, pilis exsertis, ceterum glabro, lobis oblongo-ovatis, 2 mm. longis, apice incurvis, intus minute puberulis, dorso carinatis, carina prominente; staminibus 1 mm. supra basim tubi insertis, antheris 1.5 mm. longis, linearibus; stylo longo, consperse pilosulo; stigmate capitato, lobis inconspicuis; capsulis 6 mm. latis, 3 mm. altis, minute et consperse pubescentibus.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1778* (TYPE), April 1930, alt. 1000 m., rain-forest, common (plant up to 1.5 m. tall, growing in the shade, particularly on old roads; stem covered with light hair; flowers white; fruit brown-purple).

This species is suggestive of *Ophiorrhiza amoena* Val. from the Bismarck Archipelago. In the latter species the leaves are oblong-lanceolate and glabrous; the inflorescence is more compact, and the flowers are secund along the ultimate branchlets rather than crowded as if fasciculate.

Ophiorrhiza crispa sensu Valeton, Nova Guin. Bot. 14: 237. *t. 24, fig. B, 1, 2.* 1925; an *O. crispa* Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee, Nachtr. 392. 1905?

British New Guinea: Dieni, Ononge Road, *Brass 3985,* May 1933, alt. 500 m., rain-forest floor.

The collection cited above appears to belong without question with the material pictured and described by Valeton. All these collections are from relatively low altitudes. Whether they are conspecific with the original specimen, collected at 1800 m. in the Bismarck Mountains, is not clear to us from the original description.

Ophiorrhiza glabrifolia Valeton, Bot. Jahrb. 60: 27. 1925.

Netherlands New Guinea: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13059,* March 1938, alt. 850 m., rain-forest, on sandy flood-banks of river; Bernhard Camp, Idenburg River, *Brass 13738A,* April 1939, alt. 570 m., common ground herb in rain-forests of mountain slopes. Described from Northeast New Guinea.

Ophiorrhiza rupestris Hemsley, Kew Bull. 1894: 212. 1894.

Ophiorrhiza insularis Valeton in Gibbs, Phytog. and Fl. Arfak Mountains 220. 1917, Nova Guin. Bot. 14: 238. *t. 15, fig. A, 1–3.* 1925.

Solomon Islands: Ulawa: Coast, *Brass 2943,* October 1932, amongst blocks of coral limestone, common (leaves very pale beneath; flowers white); Kulambangra: Seashore, *Herre 154,* April 1929 (suffrutescent plant about 30 cm. tall; flower white).

These collections seemed to suit this species from the Solomon Islands. Later, in checking through the species of the genus, we were impressed by the likeness of the sketch of *Ophiorrhiza insularis* Val. Further checking with the description has led us to believe that the two are identical.

Argostemma Wallich

Argostemma perplexum sp. nov.

Planta 6–15 cm. alta, erecta, interdum ramosa; caule novello vel ramis pubescentibus, internodiis 3–9 mm. longis; foliis in paribus conformibus inaequalibus, majoribus 2.5–5 cm. longis, 0.5–1.7 cm. latis, minoribus 0.7–2.5 cm. longis, 1.5–9 mm. latis, lineari-lanceolatis vel lanceolatis, utrinque angustatis, apice acutis, basi cuneatis vel acutis, supra nigrescentibus, glabris vel consperse adpresse pilosulis, subtus pallidioribus, glabris vel costa pilosula, nervis lateralibus utrinsecus 5–7 supra inconspicuis, subtus manifestis; petiolis 5–15 mm. et 2–3 mm. longis; stipulis circiter 3 mm. longis, ovatis, apice plerumque bifidis, acutis vel breviter acuminatis, recurvis; pedunculo glabro, 5–7 mm. longo, bracteato; pedicello circiter 1 cm. longo, villoso; calyce rotato, cum ovario extus villoso, lobis glabratis, ovatis, acutis, 3 mm. longis, basi 2 mm. latis; corollae lobis ovatis, acuminatis, 1 cm. longis, 4 mm. latis, margine et apice sparsim pilosis; corolla circiter 20–23 mm. diametro; staminibus cohaerentibus; antheris dorso papillosis, thecis 4 mm. longis, appendiculis membranaceis 2 mm. longis, apice emarginatis.

Netherlands New Guinea: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13422* (type), March 1939, alt. 850 m., on shaded banks of a rain-forest stream (flowers white); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12343,* Jan. 1939, alt. 1500 m., on mossy rocks in a rain-forest stream (flowers white).

It has been difficult to determine to which species this material might be

related. It is probably nearer *Argostemma griseum* Val. than to the others enumerated in Valeton's last work on the genus. In the type collection most of the plants are small, around 6 cm. tall, but one plant is 15 cm. high and branched; most of the inflorescences are single-flowered, but one plant in no. *12343* has a cyme with three flowers; sometimes the peduncle has two sets of bracts which would suggest that this inflorescence might represent a reduced cyme. Here the leaves do not seem to be at all ciliate as in *A. griseum* Val., and the stipules are definitely not rounded.

Argostemma callitrichum Valeton, Bot. Jahrb. 60: 42. 1925, Nova Guin. Bot. 14: 253. *t. 26, fig. D, 1–4.* 1925.

BRITISH NEW GUINEA: Mavi, Mount Tafa Range, *Brass 4987,* Sept. 1933, alt. 2225 m., on wet road-bank, common (fleshy small herb under cover of larger plants; leaves pale green; flowers white).

This collection agrees reasonably well with the description and plate cited above. Known from Northeast and Netherlands New Guinea.

Argostemma distichum Valeton, Nova Guin. Bot. 8: 447. 1911, ibid. 14: 251. 1925.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7205,* July 1936, alt. 100 m., associated with mosses on decaying wood and on surface-roots exposed on floor of ridge forests (whole plant fleshy; flowers white).

A perfect match for the description of the plant from Netherlands New Guinea.

Airosperma Lauterbach & K. Schumann

Airosperma psychotrioides Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 565. 1900; Val. Bot. Jahrb. 61: 32. 1927.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3879,* April 1933, alt. 500 m., rain-forest, common (shrub 1.5–2 m. high; flowers greenish white; blue fleshy fruit ± 1 cm. long, 8–9 mm. diameter). Known from Northeast New Guinea.

Airosperma ramuense Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 566. 1900; Val. Bot. Jahrb. 61: 32. 1927.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3884,* April 1933, alt. 500 m., common in a rain-forest stream bed (large shrub with dark thin flat leaves pale underneath; inflorescence in leaf-axils, on branches, or low on the stem; corolla cream-colored, base of lobes purple). Described from specimens collected in the Bismarck Mountains; previously reported only from the type-locality.

Hydnophytum Jack

When we began the study of *Hydnophytum,* we found the genus already represented in Papuasia by more than 50 species; two keys are available, one by Beccari covering the species which he described, the other by Valeton including only the species of Northeast New Guinea. In a genus as large as this one, it would greatly facilitate determinative work to have a single key based on comparable and definite characters; however, we do not think it feasible to attempt this task without access to the already numerous types. The genus appears to offer good floral characters as well as those found in the fruits. The tuberous base also would sometimes seem to have definite characters, if we may judge by the material at hand. We have not found any species with pubescent leaves or branchlets. In only

one instance were the branchlets furfuraceous, while in another a tendency appeared in that direction, but only on the youngest tips.

Hydnophytum agatifolium Val. Nova Guin. Bot. 8: 774. 1912.

Netherlands New Guinea: Hollandia, *Brass 8805, 8903,* June 1938, alt. 20–100 m., plentiful on low trees of open fern slopes, also in rain-forest on banks of stream.

These two collections, from the type-locality of this species, agree reasonably well with the original description. The section from the tuberous base is more or less spiny, the spines being about 4 mm. long and at base about 2 mm. broad. In this character as well as in the flower and the pyrene, the species shows some resemblance to *Hydnophytum Forbesii* Hook. f.

Hydnophytum magnifolium sp. nov.

Tuber subleve, subglobosum, circiter 22 cm. diametro; ramis pluribus simplicibus usque 90 cm. longis, cylindricis vel versus apicem compressis, cinerascentibus vel brunnescentibus, internodiis superioribus 4.5–6 cm. longis; foliis magnis, 12–15.5 cm. longis, 5–8 cm. latis, ellipticis, utrinque angustatis, basi apiceque acutiusculis vel obtusiusculis, costa utrinque prominente, nervis lateralibus utrinsecus 9 vel 10 oblique adscendentibus, supra prominulis, subtus manifestis, venulis supra manifestis, subtus subobscuris; petiolo 1–2 cm. longo, supra plano; stipulis inconspicuis vel caducis; floribus in utraque parte folii insertionis conglomeratis, ima basi subimmersis; calyce libero, truncato, cum ovario 2.5 mm. longo; corolla 7 mm. longa, lobis obtuse ovatis, 2 mm. longis; flore longistylo: corollae tubo supra antheras dense piloso-barbato, infra staminum insertionem inconspicue annulato-barbato; antheris inclusis; flore brevistylo: fauce et parte superiore tubi dense pilosis; antheris exsertis, filamentis brevissimis, in fauce insertis; drupis 6 mm. longis; pyrenis 2 oblongis, 5 mm. longis, 2 mm. latis, basi acutiusculis, apice bilobis, inter lobos rostratis, dorso bisulcatis.

Netherlands New Guinea: Bernhard Camp, Idenburg River, *Brass 13768, 14130* (type), April 1939, alt. 50 m., high and large epiphyte in rain-forest (tuberous base subglobose, 22 cm. diameter; several stout simple branches to 90 cm. long; flowers pale green [in the first collection cited] or white [in the second]).

This species is very close to *Hydnophytum macrophyllum* Warb. in having several stems, leaves about the same size, and flowers glomerulate. It differs in having about twice as many lateral nerves, and these are distinctly visible to the naked eye. Warburg does not say whether the flower is only in bud or near anthesis, except to note that at flowering time the calyx is longer than the disk. If his flowers were near anthesis, then his species is marked by very small flowers. In both the collections cited the flowers are more than twice as large as in Warburg's collection. The pyrene in our species is most like that of *H. Forbesii* Hook. f., the lobes being 0.5 mm. long and somewhat pointed, as well as the beak in the middle, this being 1 mm. long.

Hydnophytum heterophyllum sp. nov.

Tuber parvum consperse spinosum, spinis gracilibus, ± 1 cm. longis; caule solitario, pendulo, ± 1 m. longo, versus apicem ramoso, cylindrico; ramulis brunnescentibus leviter compressis, internodiis 1–4 cm. longis; foliis ovatis, apice obtusiusculis vel acutiusculis, basi leviter cordatis, costa

utrinque manifesta, versus basim crassiuscula, nervis lateralibus utrinsecus 5 vel 6, supra inconspicuis, subtus obscuris; foliis ramulorum ultimorum ellipticis, parvis, 2.5–3 cm. longis, 1.3–1.9 cm. latis, basi et apice acutiusculis vel obtusiusculis, costa tantum manifesta; petiolo (5–)7–10 mm. longo; floribus in axillis foliorum basi bracteis minutis praeditis; alabastro tantum viso; calyce membranaceo, truncato, disco longiore; fauce corollae tubi et basi loborum pilis rectis exsertis dense obsitis; antheris linearibus, exsertis; drupis 6 mm. longis, lageniformibus; pyrenis 4 mm. longis, basi rotundatis, apice apiculato, apiculo 0.5 mm. longo, parte superiore dorsi leviter bisulcata.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12857* (TYPE), Feb. 1939, alt. 1200 m., high epiphyte in rain-forest (stock small with one pendent stem ± 1 cm. long; flowers unopened; fruits orange-colored).

It has been difficult to determine the alliance of this species; the apiculum of the pyrene, the hairiness of the inside of the corolla, and the ovate leaves suggest *Hydnophytum Moseleyanum* var. *Teysmannii* Becc., but the latter has obovate pyrenes, and in the specimen cited they are elliptic or slightly ovate in outline; the larger leaves here show a definite venation although they are not at all prominent. There is also a possibility that the species may be allied to *H. macrophyllum* Warb., but in the latter the leaves are described as slightly obovate to elliptic. Here the difference between the outline (elliptic and ovate) and size (2.5 — 3 × 1.3 — 1.9 cm. in contrast with 6.5 — 12 × 3.5 — 7 cm.) of the leaves on the younger and older parts of the specimen is particularly striking, more so than in any of the other material of this genus which we have at hand.

Hydnophytum nigrescens sp. nov.

Tuber globosum; caule ramoso; ramulis nigrescentibus longitudinaliter rugulosis circiter 3 mm. diametro, internodiis 1.5–2.5 cm. longis; foliis ellipticis, 3.5–8.5 cm. longis, 2–4.5 cm. latis, saepissime 4.5–5 × 2–2.5 cm., apice abrupte acutis, basi cuneatis, costa utrinque prominula, nervis lateralibus utrinsecus 8 vel 9 utrinque subobscuris; petiolo 4–7 mm. longo; floribus in nodis valde tumidis, bracteatis, bracteis longe pilosis, in alveolis inclusis; calyce glabro, margine leviter lobato vel undulato, (incl. ovario) 2 mm. longo; corollae tubo 5 mm. longo, infra antheras inconspicue barbato, ostio dense barbato, pilis 1 mm. exsertis, lobis 2 mm. longis, ovatis, sub apice uncinulatis; antheris inclusis, in fauce insertis; stylo 6 mm. longo; stigmate bilobo, lobis exsertis; drupis non visis.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7171* (TYPE), July 1936, alt. 100 m., common canopy epiphyte of ridge forests (a large plant with well developed tuberous stock, galleried, but containing no ants; branches black).

Among the New Guinean species, this one seems to approach *Hydnophytum Ledermannii* Val., but the branchlets are not furfuraceous, the nerves of the leaves are obliquely spreading, and the corolla is only very sparsely hairy at the base of the anthers and between them; however, the mouth of the corolla is filled with flat hairs.

Hydnophytum Archboldianum sp. nov.

Tuber magnum subleve; ramulis angulatis, novellis compressis, subfurfuraceis (cortice rimoso), interdum longitudinaliter rugulosis, atrofuscis,

internodiis 1.5–3 cm. longis; foliis late ellipticis, 3–5 cm. longis, 1.5–3.3 cm. latis, apice obtusis vel rotundatis, basi rotundatis, margine in sicco revolutis, atro-rufescentibus, costa utrinque prominente, versus basim crassiuscula, nervis lateralibus subpatentibus, utrinsecus 4–6 supra prominulis, subtus manifestis, vel utrinque subobscuris; petiolo circiter 2 mm. longo, crassiusculo; floribus in nodis tumidis, in alabastro bracteis intus longe pilosis inclusis; floribus sub anthesin partim exsertis; calyce cupulari, truncato, interdum minute denticulato, glabro; corolla infundibulari, corollae tubo 9–10 mm. longo, fauce minute papilloso-pubescente, lobis oblongis, 3–3.5 mm. longis; antheris partim exsertis, 2.5 mm. longis, linearibus, basi sagittatis, medio dorso affixis; stylo 12 mm. longo; stigmate bilobato, lobis linearibus; drupis obovatis, 8 mm. longis; pyrenis 2 vel 3, obovoideis, 3 mm. longis, apice rotundatis, basi anguste obtusis.

Netherlands New Guinea: Lake Habbema, *Brass 9506* (type), Aug. 1938, alt. 3225 m., epiphytic in forests of moist hollows, common (shrub with large tuberous stock and long straggling branches; stock purple inside; leaf-nerves slightly impressed below, prominent above; flowers purple-red, solitary in axils); same locality, *Brass 9240, 9492,* August 1938, alt. 3225 m., occasional in edge of forest and in forest undergrowth (erect somewhat fleshy shrub ± 1 m. high; flowers pale purple and purple-red; fruit red, fleshy).

Hydnophytum Archboldianum is perhaps most nearly related to *H. Ledermannii* Val. It may readily be distinguished from the latter species by its different leaves and flowers. Superficially it seems to be easily recognized by its dark reddish practically sessile elliptic leaves which appear to have buds in their axils. On closer examination, one finds that these are really bracts (5–7 mm. long) protruding from shallow alveoli, which cover the flower buds. Only a very few species of *Hydnophytum* have bracts as large as these. At anthesis the corolla projects above the bract about half its length; usually there is only one flower to a bud, but occasionally there are more. The fruit of the type is immature, the description being taken from a ripe drupe of no. *9492*. In both the type and in no. *9240* we have found three locules. Whether this indicates a four-seeded fruit with one aborted or whether the normal number of locules in the fruit is two, we are not prepared to say. It should be noted that the type is described as having a tuberous stock, whereas the other two collections cited are described as shrubs. These in Mr. Brass' opinion were mature shrubs, not young plants in which the tuber might not yet have developed. In a discussion of *H. radicans* Becc., Valeton points out that the tuberous base is sometimes lacking in that species, and of course *H. normale* Becc. has no tuberous base, but is epiphytic.

Hydnophytum contortum sp. nov.

Tuber rotundatum, subleve, irregulare, ± 28 cm. diametro; caulibus pluribus brevibus (in specimine typico ± 30 cm. longis), ramosis, cinerascentibus; ramis argute tetragonis, in parte superiore compressis, atro-fuscis vel brunnescentibus, cortice longitudinaliter ruguloso, internodiis 1–4 cm. longis; foliis ellipticis vel leviter obovatis, 3–6 cm. longis, 1.5–3.8 cm. latis, apice rotundatis, basi rotundatis vel obtusis vel cuneatis, coriaceis, costa supra impressa, subtus prominula, nervis lateralibus utrinsecus 4 vel 5 utrinque inconspicuis vel subobscuris; petiolo plerumque 2–4 mm. longo;

floribus in nodis valde tumidis, bracteis dense rufo-pilosis praeditis; calyce margine ciliato, ciliis 1 mm. longis, dense confertis; corollae tubo 5 mm. longo, fauce annulato-barbato, lobis ovatis sub apice uncinulatis; staminibus in ostio tubi insertis, filamentis 0.5 mm. longis, antheris 1 mm. longis, oblongis, exsertis; drupis lageniformibus, 5 mm. longis; pyrenis 2 obovatis, 4 mm. longis, apice rotundatis, basi acutis.

BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5849* (TYPE), common on savanna trees (several short contorted stems produced from a large rounded tuberous stock; a typical tuberous base measured 28 cm. in diameter with surface smooth, brown, and very irregular; leaves shining, thick, fleshy; flowers white; fruit soft, reddish orange).

Possibly this species should have been placed in *Hydnophytum tortuosum* Becc., with which it agrees in foliar and stem characters; in Beccari's species the calyx is described as being densely pilose-paleaceous with a short truncate or very obscurely denticulate limb. In *H. contortum,* the limb of the calyx is very short, being about even with the margin of the disk, and the margin of the calyx is clothed with a very dense row of brown cilia about 1 mm. long. The flowers on the plant were scarce, but this character persists in fruit. The only other place we find mention of a comparable character is in the description of *H. Kochii* Val. Here Valeton says the berry is crowned by the disk surrounded by a ring of castaneous hairs. Apart from the ciliate margin, in our species the calyx and ovary are glabrous. This is just another instance where it is necessary to re-examine a type in order to be sure of the characters of a species.

Hydnophytum longistylum Becc. Malesia 2: 152. *t. 38, figs. 1–10.* 1885; Guppy, The Solomon Islands and their Natives, 297. 1887; Valeton, Bot. Jahrb. 61: 136. 1927.

SOLOMON ISLANDS: San Cristoval: Waimamura, *Brass 2855,* September 1932, epiphytic on beach trees, common (stems numerous on a large tuberous base, irregular in form and varying greatly in size, with an uneven muricate surface pierced by numerous entrance-holes of the small brown ants which inhabit it; stems 1 m. or more long, often galled, the nodes swollen; leaves very thick and fleshy, the veins obscure [visible when dry]; flowers white; fruit yellow, about 9 mm. long, 4 mm. diameter, with two large white seeds enclosed in mucilaginous pulp).

From Guadalcanal Island, there are two collections which in all details agree with *Hydnophytum Stewartii* Fosberg, Lloydia 3: 123. *fig. 5.* 1940. These are *Brass 2548* and *Kajewski 2389,* one collected at Berande, the other on the Berande River; the field notes indicate a plant with branches pendulous from a tumid stock inhabited by great numbers of small brown ants; the branches are more than a meter long. Kajewski describes the fruit as cream-colored, thickest at the base, tapering to a blunt point, 8 mm. long, 3 mm. in diameter. Unfortunately our specimen does not have ripe fruit. In every other respect, as far as we can see, except in the size of the flowers, these collections agree with the collection from San Cristoval, the latter having flowers with the dimensions given for *H. longistylum* Becc. Beccari and Valeton both indicate glomerulate flowers without a tubercle; this is true of the upper nodes, but on the lower nodes of our specimen the inflorescence consists of flowers and fruit at the end of a tubercle about 4 mm. long, just as in *H. Stewartii* Fosb. Owing to the differ-

ence in the size of the flowers and the lack of sufficient material to estimate the range of variation, we are keeping both species in the *status quo* for the present. Beccari had only very fragmentary material on which to describe his species, and it seems very possible that he had one of the upper nodes at hand when he says that neither tubercle nor peduncle was present.

Hydnophytum ellipticum sp. nov.

Tuber parvum, ± 10 cm. diametro; ramulis cinerascentibus vel brunnescentibus, longitudinaliter rugulosis, cylindricis, novellis compressis, internodiis 1.5–3 cm. longis; foliis ellipticis, 4–8 cm. longis, 2–4.3 cm. latis, utrinque angustatis, basi et apice acutiusculis vel obtusiusculis, costa utrinque prominente, nervis lateralibus utrinsecus circiter 4, supra inconspicuis, subtus subobscuris; petiolo 3–8 mm. longo, crassiusculo; floribus in alveolis, axillaribus, bracteis suffultis; calyce parte superiore libero, glabro, (incl. ovario) 2 mm. longo, margine truncato; corollae tubo 4 mm. longo, fauce et lobis basi dense barbato, pilis in fauce patentibus, in lobis erectis, lobis 2 mm. longis, oblongis; filamentis brevibus, in fauce insertis, antheris 1.5 mm. longis, linearibus, parte superiore exsertis; stylo 5 mm. longo; drupis 4 mm. longis; pyrenis 3 mm. longis, obovatis, apice rotundatis, basi acutiusculis, dorso convexis.

Netherlands New Guinea: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12111* (type), Jan. 1939, alt. 1800 m., frequent epiphyte in mossy forest (tuberous base small, about 10 cm. diameter; flowers white).

This species is possibly related to *Hydnophytum nigrescens,* but it is readily distinguished by the light-colored branches and the more shallow alveoli; in addition, the throat of the corolla is densely hairy, and the bracts in the alveoli are not so conspicuously hairy as in the species from the Palmer River.

Hydnophytum myrtifolium sp. nov.

Tuber irregulare; caulibus ramosis; ramis compressis vel leviter angulatis, brunnescentibus vel cinerascentibus, gracilibus; ramulis ultimis circiter 2 mm. diametro, internodiis 1–4 cm. longis; foliis ellipticis vel ovato-ellipticis, 1.5–4 cm. longis, 0.5–2.2 cm. latis, apice acutiusculis vel obtusis, basi obtusis vel cuneatis, in sicco margine recurvis, supra rugulosis, subtus plerumque planis, costa utrinque distincta, nervis lateralibus utrinque obscuris; petiolo 2–5 mm. longo; floribus in axillis foliorum confertis; bracteis minutis; calyce (incl. ovario) 2 mm. longo, glabro, truncato, membranaceo; corollae tubo 6 mm. longo, ostio barbato, lobis 2 mm. longis, ovatis; antheris in apice tubi sessilibus, medio dorso affixis, linearibus vix 2 mm. longis; stylo 7 mm. longo; pyrenis 2 ellipsoideis, 3 mm. longis, apice et basi rotundatis, dorso convexis.

British New Guinea: East Mount Tafa, *Brass 4093* (type), May 1933, alt. 2100–2300 m., common epiphyte in both mossy and foothill forests (closely attached by several roots or pendent on a single tough flexible root up to 1 m. long; the swollen irregularly shaped stock of a typical plant measured 20 cm. diameter, and was hollowed in wide galleries containing a quantity of water but no ants; some plants were found to contain a species of small red tree frogs; no ants were found in any of the specimens examined; leaves fleshy and shining, darker above; flowers white; fruit fleshy, red, ± 3 mm. diameter); Murray Pass, Wharton Range, *Brass 4589,* July 1933, alt. 2840 m., epiphytic on trunks of forest trees, not plentiful (branches produced from a rounded

tuberous base 20 cm. or more in diameter; branches ridged and finely rugose; leaves dark; corolla white, the tube ± 1 cm. long; fruit bright red, soft, 6–7 mm. diameter).

In leaf-size this species probably falls somewhere near *Hydnophytum cordifolium* Val. and *H. parvifolium* Val. Both the latter species have flowers on very short tubercles. However, having observed the variation in tubercles and lack of them, it seems best to note that other species have been observed where the flowers are sometimes apparently sessile in upper axils, while those flowers farther down may be at the tip of a short tubercle in the axil. Neverthless, there are distinct and definite floral characters which set this species apart from the other small-leaved species. The corolla is rather large, with a long tube barbate at the mouth only. In most species with the mouth of the tube barbate, the throat or the space immediately below the anthers is also hairy. The anthers are sessile and attached by the middle of the back, being only half exserted from the mouth of the flower; the pyrenes too seem to be reasonably distinctive in the rounded base.

Hydnophytum confertifolium sp. nov.

Tuber parvum spinis conspersis praeditum; spinis ± 1 cm. longis interdum ramosis; caulibus pluribus ramosis; ramis angulatis; internodiis ultimi ramuli ± 1.5 mm. longis; foliis glabris subrotundatis, circiter 5 mm. longis et 4 mm. latis, in sicco rugulosis, margine recurvis, costa tantum basi manifesta; petiolo 1–2 mm. longo; stipulis parvis, late triangularibus, caducis; floribus in axillis foliorum insertis, ima basi immersis; calyce libero, glabro, margine undulato vel leviter lobato, cum ovario 2 mm. longo; corolla in alabastro clavata, apice 4-angulata, acutiuscula; corollae tubo 7–8 mm. longo, fauce parce piloso, lobis circiter 3 mm. longis, sub apice uncinulatis; antheris lineari-oblongis in fauce insertis, fere sessilibus; stylo longo, stigmate exserto; drupis maturis cum calyce 6 mm. longis; pyrenis 3 mm. longis, 2 mm. latis, obovatis, apice rotundatis, basi acutiusculis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12680* (TYPE), Feb. 1939, alt. 2150 m., mossy forest (high epiphyte; tuberous base small and bearing branched thorns; leaves concave; flowers greenish white with green apex; fruit red).

Although the corolla in bud strongly suggests that of *Hydnophytum alboviride,* the species is probably closer to *H. Vitis-Idaea.* Both species have flowers few in number (i. e. in an inflorescence), the base immersed in a small alveolus, the calyx free and either shallowly lobed or minutely denticulate, and small leaves. They are readily distinguishable by various characters: in *H. confertifolium* the tuberous base is thorny with scattered spines, and the flower-bud is clavate, tapering at the apex; in *H. Vitis-Idaea* the corolla-tube is slender and the lobes form an elliptic outline at the end, as if the flower might be hypocrateriform when open; the pyrenes are different in outline, the one being oblong, the other obovate, although they belong to the same general type.

Hydnophytum decipiens sp. nov.

Tuber subleve; caule versus basim circiter 5 mm. diametro, ramoso; ramis acute tetragonis, cinereis; internodiis 1–3.5 cm. longis; foliis ovatis vel rotundato-ovatis vel ellipticis, (1.1–)1.5–2 cm. longis, 0.7–1 cm. latis,

apice acutiusculis vel obtusis, basi rotundatis interdum cuneatis, in sicco supra minute rugosis, subtus planis, glabris, costa utrinque manifesta, nervis lateralibus obscuris; petiolo 1–2 mm. longo; stipulis non visis; floribus in axillis foliorum insertis, ima basi immersis; calyce in parte superiore libero, truncato, corollae tubo 4 mm. longo, intus glabro, fauce glabro, lobis 2 mm. longis, obtusiusculis sub apice uncinulatis; antheris 1.5 mm. longis, linearibus, in fauce insertis; stylo 5.5 mm. longo; stigmate exserto; drupis 4 mm. longis, pyrenis 2.5 mm. longis, 2 mm. latis, apice rotundatis, basi acutiusculis.

Netherlands New Guinea: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12684* (type), Feb. 1939, alt. 2150 m., mossy forest, on branches of large trees (branches weak, ± 60 cm. long; flowers white).

This species seems to be closest to *Hydnophytum parvifolium* Val., at least as regards leaf-variation. It has been a little difficult to be sure where the line of distinction lies between an incipient tubercle and a shallow alveolus, both of which sometimes have bracts. Here the basal part of the flower appears to be covered by small bracts, but there is no elongation of the process indicating a tubercle, nor is there any great enlargement of the node indicating a deep alveolus.

The species is very close to our *Hydnophytum Vitis-Idaea,* but in the latter the throat has an erect pilosity which is lacking here.

Hydnophytum Vitis-Idaea sp. nov.

Tuber usque 15 cm. diametro, subleve; ramis ± 45 cm. longis, ramosis, basi 4 mm. diametro, glabris; ramulis angulatis vel novellis compressis, cortice apice transverse rimoso; internodiis ultimi ramuli 3–8 mm. longis; foliis glabris, subcoriaceis, late ellipticis interdum obovatis, minoribus fere rotundatis, 0.3–1 cm. longis, 0.2–0.5 cm. latis, apice rotundatis, basi cuneatis vel obtusis, in sicco supra rugosis, subtus levibus, costa utrinque leviter manifesta, nervis lateralibus obscuris; petiolo 0.5–1.5 mm. longo; stipulis inconspicuis vel mancis; floribus in utraque parte folii insertionis 1 vel 2 confertis, ima basi immersis; calyce libero glabro, minute denticulato, cum ovario 2 mm. longo; corollae tubo circiter 6 mm. longo, fauce erecto-piloso, pilis apice exsertis, lobis 5 mm. longis, oblongis, uncinulatis, intus minute puberulis; antheris linearibus in fauce insertis; stylo 9 mm. longo; stigmaticis lobis 1 mm. longis; drupis oblongis, cum calyce 4 mm. longis, 2 mm. latis; pyrenis oblongis, 3 mm. longis, apice rotundatis, vix 1.5 mm. latis, basi leviter angustatis.

Netherlands New Guinea: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12046* (type), Jan. 1939, alt. 1800 m., mossy forest (a common epiphyte on the branches of tall trees; tuberous base up to ± 15 cm. diameter; flowers white; fruit red).

The species is perhaps related to *Hydnophytum parvifolium* Val., but the leaves are smaller and of different outline, and the flower is much larger. Without the tuber, the plant suggests a loose form of *Vaccinium Vitis-Idaea* var. *minus* Lodd., although the leaves are smaller than in that plant.

Hydnophytum alboviride sp. nov.

Tuber subleve cinereum; ramis usque 1 m. longis, ramosis, obtuse angulatis, fusco-cinereis; ramulis compressis, sulcatis, atrofuscis; internodiis ultimi ramuli 0.5–1 cm. longis; foliis 0.9–1.5 cm. longis, 0.7–1.3 cm. latis,

late ovatis vel subrotundatis, apice acutiusculis vel rotundatis, basi rotundatis, in sicco subcoriaceis, brunneis, utrinque minute rugosis, costa tantum versus basim manifesta, nervis lateralibus obscuris; petiolo 1.5–2 mm. longo, crassiusculo; stipulis truncatis; floribus sessilibus in alveolis ad articulationes nidulantibus paucis (1 vel 2), basi in bracteis pilosis involutis, in alabastro clavatis; calyce truncato glabro, margine ciliato, pilis 0.5 mm. longis, calyce cum ovario 2 mm. longo; corolla infundibulari, tubo 7 mm. longo intus glabro, lobis 2 mm. longis, obtuse triangularibus, sub apice uncinulatis; antheris 1.5 mm. longis, medio dorso in fauce tubi affixis, apice tantum exsertis; stylo 1 cm. longo; stigmate exserto; drupis non visis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12682, 12683* (TYPE), Feb. 1939, alt. 2150 m., mossy forest, epiphytic on branches of large trees (a large plant with branches up to 1 m. long, erect; leaves flat; flowers greenish white).

Of the species of *Hydnophytum* already described from New Guinea, this one superficially suggests *H. Hellwigii* Warb., but it differs considerably in specific details. Apart from the small leaves, the summary of the distinctive characters of this species might be indicated as: flowers in alveoli surrounded by bracts and long brown hairs; calyx with cilia 0.5 mm. long, also brown; corolla glabrous within; anthers closely affixed by the middle of the back, only the apices exserted. On the long leafless branches (the leaves often being only toward the tip), flowers or buds with the corolla half protruding may be observed at the nodes.

Hydnophytum buxifolium sp. nov.

Tuber subleve; ramis tetragonis, cinerascentibus; ramulis ultimis anguste alatis; internodiis 5–10 mm. longis; foliis lanceolatis, utrinque aequaliter angustatis, basi et apice anguste obtusis, utrinque minute rugulosis, 0.7–1.3 cm. longis, 0.3–0.6 cm. latis, costa tantum manifesta; petiolo circiter 1 mm. longo, crassiusculo; stipulis caducis; floribus in axillis foliorum bracteis suffultis; bracteis minutis; calyce (incl. ovario) 1.5 mm. longo, margine leviter lobato, glabro; corollae tubo 3 mm. longo, fauce dense barbato, pilis subexsertis, lobis oblongis obtusiusculis, sub apice uncinulatis, 2 mm. longis; antheris exsertis, oblongis, 1 mm. longis, filamentis 0.5 mm. in fauce insertis; stylo brevi, vix 3 mm. longo; drupa immatura, 2.5 mm. longa.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12681* (TYPE), Feb. 1939, alt. 2150 m., high epiphyte in mossy forest (flowers white).

Hydnophytum buxifolium most closely approaches *H. punamense* Lauterb., from the Bismarck Archipelago; however, in the New Guinean material the leaves are about twice as broad in proportion to their length, and the flowers are very much larger. Valeton has reported Lauterbach's species from southwestern Netherlands New Guinea, but he has added nothing to the original description except that, in his key to species of Northeast New Guinea, he gives larger dimensions for the leaves than those given in the original description.

Hydnophytum ramispinum sp. nov.

Tuber parvum ovoideum spinis praeditum; spinis 1.5–2 cm. longis, ramosis, interdum ramis ramosis, gracilibus; caulibus pluribus, 70–80 cm. longis,

ramosis; ramulis ultimis compressis, angulatis, cortice furfuraceis; internodiis 1.5–4 cm. longis; foliis glabris subcoriaceis, lineari-oblongis, 3–6 cm. longis, 0.6–0.9 cm. latis, apice obtusis, basi rotundatis vel obtusis, in sicco leviter rugulosis, costa supra impressa, subtus prominula, nervis lateralibus obscuris; petiolo circiter 1 mm. longo; stipulis caducis; floribus 3–5 in axillis foliorum confertis, ima basi immersis; alabastro 2.5 mm. longo; calyce membranaceo truncato (incl. ovario) 1 mm. longo; corollae tubo 1 mm. longo, fauce sparsim pilosulo, lobis obtusis, 1 mm. longis; antheris in fauce insertis, 1 mm. longis; stylo brevi; drupis non visis.

Netherlands New Guinea: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12858* (type), Feb. 1939, alt. 1200 m., rain-forest; common epiphyte of middle spaces (stock small, ovoid; stems several, pendent, 70–80 cm. long; flowers yellow).

In leaf-size and flower, this species is near *Hydnophytum stenophyllum* Val. and *H. punamense* Lauterb. In both the latter species the leaves are either attenuate-acute or acute, and in neither is there any mention of the furfuraceous character of the young bark. Unfortunately many of the species have no indication of the characters of the tuberous base. In this the slender branching spines are most distinctive.

Hydnophytum punamense Lauterb. Fl. Deutsch. Schutzgeb. Südsee, Nachtr. 401. 1905; Valeton, Nova Guin. Bot. 8: 508. 1911, Bot. Jahrb. 61: 140. 1927.

Netherlands New Guinea: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 13008*, Feb. 1939, alt. 1450 m., epiphytic on tall rain-forest tree (tuberous base small, ovoid, 14 × 10 cm.; branches ± 50 cm. long; flowers white; fruit yellow); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13403, 13413*, March 1939, alt. 850 m., common high epiphyte in rain-forest (branches upright; flowers white, very small; fruit orange-colored).

Valeton reported this species from southwestern Netherlands New Guinea, but we have thought it worth while to record it here and to call attention to the variation in the size and the form of the leaves. In the original they are described as lanceolate or sublinear, acute, the base subrounded or acute. Some of the smaller might be considered as linear-oblong, obtuse, with cuneate base, and in most of them, although the apex is narrow, it is not sharply pointed; the leaves vary in size from 2 to 5 cm. in length and from 0.5 to 1.3 cm. in breadth. We note this particularly, as Valeton, in his key to the species of Northeast New Guinea, says that the leaves are at most 35 × 7–8 mm. We have been unable to find any differences in the flowers and fruits of the collections at hand, although the flowers are 2 mm. long rather than 1 mm., as stated in the original description.

Hydnophytum longipes sp. nov.

Tuber? . . .; ramulis subangulatis vel novellis tetragonis, atrofuscis vel brunnescentibus, internodiis 1.5–9 cm. longis, foliis in sicco membranaceis, lanceolato-ellipticis, 5–15 cm. longis, 2.5–5.5 cm. latis, basi et apice aequaliter angustatis, apice acutis, basi cuneatis vel acutis, costa utrinque prominula, nervis lateralibus utrinsecus 8–10 utrinque distinctis, non prominulis, oblique adscendentibus deinde arcuatis; petiolo 3–7 mm. longo; stipulis 2 mm. longis, acutiusculis interdum apice breviter acuminatis, caducis; inflorescentiis pedunculatis, bifurcatis, pedunculo 3–5 cm. longo,

ramis 1–1.5 cm. longis, ramulis ultimis 1–2.5 cm. longis, cicatricosis, floribus et fructibus apice et versus apicem ramulorum ultimorum sessilibus; calyce ima basi immerso (incl. ovario) 1 mm. longo, truncato, disco breviore; corolla in alabastro tantum visa, fauce annulato-barbato, lobis 2 mm. longis, basi pilis erectis praeditis, oblongis; staminibus in fauce tubi insertis, filamentis brevibus, antheris 1 mm. longis, lineari-oblongis, sub anthesin exsertis; stylo longo, stigmate probabiliter exserto, bilobato; drupis 5 mm. longis, ovoideis; pyrenis ellipsoideis, 4 mm. longis, basi et apice subrotundatis, dorso convexis.

SOLOMON ISLANDS: Bougainville: Kieta, *Kajewski 1571* (TYPE), March 1930, at sea-level, rain-forest (plant found growing on large tree, up to 1 m. long; flowers minute, green, with a prominent style; fruit yellow, semi-transparent, 7 mm. long, 4 mm. in diameter, oval-shaped).

Hydnophytum longipes belongs in the same group with *H. normale* Becc. and *H. radicans* Becc. It has, however, lanceolate-elliptic leaves with short petioles, narrower anthers, and the pyrenes are rounded at the apex, not at all emarginate as in the latter species.

Hydnophytum radicans Becc. Malesia 2: 132. *t. 30.* 1885; Valeton, Nova Guin. Bot. 8: 503. 1911, op. cit. 771. 1912; Lam, Nat. Tijds. Nederl.-Ind. 88: 204. 1928.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7172,* July 1936, alt. 100 m., common ridge-forest canopy epiphyte (tuberous stock small; branches long, weak and semi-herbaceous; leaves fleshy; flowers green; fruit soft, red, ± 5 mm. long, 3 mm. diameter).

This collection agrees with Valeton's description which he has given for material placed in this species with a query, but it also agrees fairly well with the original. The inflorescence shows great variation in size, the peduncle being from 2.5 to 6 cm. long, and the rest of the inflorescence 2–8 cm. long and 4–14 cm. broad.

Hydnophytum albense Valeton, Bot. Jahrb. 61: 128. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13980,* April 1939, alt. 50 m., flood-plain rain-forest (low epiphyte; flowers white).

The petioles are only about two-thirds as long as those described in the original; the differences between this species and *Hydnophytum subnormale* K. Schum. are not quite clear to us from Valeton's key, and the types would appear from the descriptions to be more or less fragmentary.

Hydnophytum Albertisii Becc. Malesia 2: 136. *t. 45, figs. 8–14.* 1885; Val. Nova Guin. Bot. 8: 772. 1912.

BRITISH NEW GUINEA: Fly River, 528 mile Camp, *Brass 6599, 7011,* May 1936, alt. 80 m., commonly associated with ferns, mosses, and orchids on branches of canopy trees (tuberous base often reduced to a series of small swellings on stem, or entirely absent in young plants already flowering; stems quadrangular; leaves bluish green).

There can scarcely be any doubt that these two collections belong to Beccari's species. Some of the leaves are even more sharply acuminate than that in Beccari's plate. The plants have flowers with both long and shorter styles. Those with the long style correspond to Beccari's figures. In the other the stamens, instead of being inserted in the tube and included, are inserted in the mouth of the corolla-tube, and thus are exserted with the very thick tuft of hairs which protrudes from the mouth of the corolla;

below the stamens the tube is densely hairy in the upper half or nearly two thirds; the style reaches only to the base of the anthers; the stigma is not distinctly lobed in the buds examined; the fruit is 4 mm. long, and one contained 4 pyrenes, another contained 3, while the other probably did not develop; the pyrenes are 3.5 mm. long, linear-oblong in outline or slightly wider at base (1 mm.), obtuse at the apex and base. Both plants appear to be developing fruits.

Hydnophytum Hahlii Rechinger, Rep. Spec. Nov. 9: 186. 1912, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien 89: 612. *t. 2, fig. 3a.* 1913?

Solomon Islands: San Cristoval: Hinuahaoro, *Brass 2912,* Sept. 1932, alt. 900 m., mountain forests (small trees; branches swollen at the nodes; leaves pale, flat, fleshy, the nerves more prominent above; flower white; fruit smooth, 6 × 4 mm., marked longitudinally with white lines).

We have placed this specimen here with some hesitation. Rechinger's species grew on the branches of strand trees. However, the flowers on the specimen at hand are only in young bud, and when mature the stamens would be exserted, and for this reason the hairiness within the corolla is correspondingly different. The buds indicate a very dense growth of hairs protruding from the mouth of the corolla. The pyrene is more rounded than attenuate at the base. Neverthless the plate of Rechinger's species is so much like the plant at hand that we hesitate to place it elsewhere without further material for comparison.

Hydnophytum Guppyanum Becc. Malesia, 2: 133. *t. 40.* 1885; Guppy, The Solomon Islands and their Natives, 297. 1887; Rechinger, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien 89: 612. 1913.

Solomon Islands: Ysabel: Tataba, *Brass 3421,* Jan. 1933, alt. 50 m., epiphytic on rain-forest trees, plentiful (stems under 1 m. long, ascending or pendent from a large swollen base much tunnelled by small brown ants; leaves fleshy, the upper side dull, the lower paler and shining; fruit reddish).

Rechinger was not sure of the determination of his specimen, but there can be no doubt that this is the same species as was described from the Shortland Islands.

Hydnophytum Kajewskii sp. nov.

Tuber? . . .; caulibus ramosis; ramis acute tetragonis, internodiis 1.5–2 cm. longis; foliis subrotundis, 1–2.7 cm. longis, 0.9–2.4 cm. latis, apice rotundatis vel obtusis, basi cordatis, sessilibus, in sicco margine leviter recurvis, costa utrinque manifesta versus basim leviter incrassata, nervis lateralibus utrinsecus 4–6 supra prominulis, subtus manifestis vel inconspicuis, oblique patentibus; inflorescentiis in axillis graciliter pedunculatis, furcatis; pedunculo 1–1.5 cm. longo tetragono vel compresso; ramis plerumque 1 cm. longis dense cicatricosis; floribus paucis apice rami insertis, alabastris tantum visis; calyce truncato glabro, cum ovario 2 mm. longo; corollae tubo 3 mm. longo, fauce annulato-barbato, lobis 2 mm. longis, oblongis, glabris; filamentis in fauce tubi insertis, antheris 1.5 mm. longis, oblongis; stylo fere 4 mm. longo; drupis non visis.

Solomon Islands: Bougainville: Kupei Gold Field, *Kajewski 1716* (type), April 1939, alt. 1000 m., growing from a huge bulb on rain-forest trees (flowers white; fruit 6 mm. long, 4 mm. diameter, irregularly ovoid, green when ripe, with white longitudinal lines).

The leaves of this species at once call to mind the plate of *Hydnophytum ovatum* Becc. But in the latter species the flowers are inclosed in alveoli. As far as we know, this is the only species with small rounded leaves and pedunculate inflorescences.

Myrmecodia Jack

With so little material available for examination, it has not been easy to estimate the variability of specific characters in *Myrmecodia*. In the work here presented, we have relied chiefly on floral characters, those of the alveoli, and of the spines of the stem and tuberous base. The fruits do not have as distinctive features as those of *Hydnophytum* Jack. Occasionally the stipules offer unusual characters. In both *Hydnophytum* and *Myrmecodia* the pubescence within the corolla may vary according to whether the stamens are included or exserted. In Vegetationsbilder **15** (Heft 7), Professor H. J. Lam has a richly illustrated article on the species of *Myrmecodia* and *Hydnophytum* which he collected on the van Overeem Expedition to New Guinea, 1920–21. This contains much general information. Unfortunately, so far as we have been able to learn, the descriptions of Lam's specimens have not yet been published. In conjunction with this paper we are publishing a plate of five photographs taken by Mr. L. J. Brass during his collecting trips; these give a limited idea of the variation of habitat and habit. In examining the specimens of *M. Lamii* and *M. Brassii*, we found two types of spines on different pieces of the tuberous base, and supposed we had mixed the material in sorting, but on appealing for help to Mr. Brass, we found that the two belonged to the same base; he sent us a photograph illustrating this, and it (in part) is reproduced in the plate.

Myrmecodia Antoinii Becc. Malesia **2**: 116. *t. 19, figs. 2–4.* 1884; Hook. f. Bot. Mag. 123: *t. 7517.* 1897; F. M. Bail. Queensl. Fl. 3: 775. 1900, Queensl. Agric. Jour. 27: 66. *t. 18.* 1911.

Myrmecodia echinata sensu Antoine Oest. Bot. Zeitschr. 32: 347. *tab.* 1882, non Gaud.

BRITISH NEW GUINEA: Daru Island, Western Division, *Brass 6447,* April 1936, common epiphyte on savanna-forest trees; Tarara, Wassi Kussa River, *Brass 8670,* January 1937, common epiphyte in low savanna-forests.

This species was originally described from specimens collected on Thursday Island in Torres Straits. It has also been reported from Moa Island. Southern Papua is a logical extension of its range.

Myrmecodia tuberosa Jack, Trans. Linn. Soc. **14**: 123. 1823; Becc. Malesia **2**: 99. *t. 13, 14.* 1884?

BRITISH NEW GUINEA: Kanosia, *Carr 11517,* mangrove swamps, Feb. 1935 (epiphyte, ant-infested; flowers mostly white).

Although somewhat skeptical of the range of this species, this is more like the Malayan species than any other illustrated by Beccari. The specimen does not appear to have any flowers, and hence we are making only a provisional determination. Beccari gives the range of the species as Malay Peninsula, Sumatra, Borneo, and Java.

Myrmecodia Lamii sp. nov. Pl. I, fig. E.

Tuber usque ± 70 cm. longum et 40 cm. diametro, irregulariter costatum, spinosum, in parte inferiore ecostatum spinis crassiusculis in manipulis sparsis ± 6 mm. longis ornatum, in parte superiore spinis gracilibus simplicibus vel aggregatis vel a basi ramosis 7–22 mm. longis praeditum; caulibus 3–4.5 cm. diametro (cum spinis), versus apicem foliosis, clypeolatis; clypeolis 1.5 cm. longis, 1 cm. latis, ultra insertionem petioli spinas paucas gerentibus; stipulis magnis profunde bifidis, lobis elongatis 1.5–2 cm. longis divergentibus ad basin cum clypeolo ad latera connatis; foliis 8–22 cm. longis, 2–3.5(–6) cm. latis, oblanceolatis, apice abrupte acutis vel obtusiusculis, basi sensim in petiolum 1–3 cm. longum attenuatis, coriaceis, nervis lateralibus utrinsecus 8–10, supra manifestis, subtus prominulis, margine crispis vel recurvatis; alveolis interclypeolaribus marginibus radiculosis, radiculis brevibus ramosis; floribus in alveolis profunde nidulantibus; bracteis membranaceis involucratis, intus dense fuscis pilosis (filamentosis), pilis 4 mm. longis; calyce cupulari, 3 mm. longo, membranaceo, margine undulato vel leviter lobato; corollae tubo 7–8 mm. longo, intus glabro, lobis oblongis, 4 mm. longis, apice acutis, 1 mm. infra apicem uncinulatis; antheris 2.5 mm. longis, dorso infra medium affixis, in apice tubi insertis; disco profunde concavo; stylo 9 mm. longo; stigmate 4-lobato, lobis parvis; ovario 4-loculari; pyrenis subtrigono-compressis, 6 mm. longis, 1.5–2 mm. diametro, punctulatis.

Netherlands New Guinea: Lake Habbema, *Brass 9445* (type), Aug. 1938, alt. 3225 m., abundant, characteristic, and very conspicuous large gouty epiphyte in open peaty communities, on *Libocedrus,* and on various trees in low mossy thickets, also terrestrial in shrubberies and grassy glades (tuberous base covered with erect bristles to over 2 cm. long, elongated, about 50–70 cm. long, 30–40 cm. in diameter, usually protruding at right angles with the host tree, upright and thicker in proportion to length when terrestrial; branches several from a common apex, up to about 1 m. long and 5 cm. in diameter; leaf-margins recurved, the midrib sharply keeled below; flowers white, the anthers blue); 9 km. northeast of Lake Habbema, *Brass 10689,* Oct. 1938, alt. 2800 m., common epiphyte, usually high on the branches of tall trees but coming down close to the ground on dead trees in clearings (leaves concave, the margins crinkled and recurved; flowers pale blue); Bele River, 18 km. northeast of Lake Habbema, *Brass 11554,* Nov. 1938, alt. 2200 m., a common epiphyte on trees along the river (leaves concave; flowers bluish white).

This species is readily distinguished from the others which superficially resemble it in habit by the very conspicuous stipules which have divergent tips and which, at the base, extend along the sides of the clypeoli, forming a somewhat wing-like margin; the spines on the clypeoli are variable in number, on younger ones sometimes two or three or a small cluster, or perhaps none. The flowers have a rather thick corolla which is glabrous within, whereas in most other species the corolla is thick in the upper part, becoming membranous in the lower part. The only species-description which we find even suggesting a relationship is that of *Myrmecodia longissima* Val., Bot. Jahrb. 61: 148. 1927; the latter, however, has leaves three times as large and different in outline, as well as different floral characters, the corolla-lobes being linear and the tube within provided with a ring of hairs near the base.

We have named this species for Professor H. J. Lam, who, we believe,

discovered it first. In Vegetationsbilder 15(Heft 7): *t. 37, 38, 40.* 1924, Professor Lam has given some excellent illustrations, but it seems rather unfortunate that some formal descriptions were not published in anticipation of the article or accompanying it; possibly these have been published, but, if so, we have not yet discovered the record.

Myrmecodia Brassii sp. nov. PL. I, FIG. A-C.

Tuber irregulare, versus apicem costatum, spinosum, in parte inferiore ecostatum spinis crassiusculis in manipulis sparsis ± 6 mm. longis ornatum, in parte superiore spinis numerosis gracilibus simplicibus saepe subaggregatis 6–13 mm. longis praeditum; caulibus (cum spinis) 3–4 cm. diametro, subobscure clypeolatis, clypeolis ± 10 mm. diametro, sursum consperse et margine dense spinosis, spinis simplicibus gracilibus, 7–15 mm. longis; stipulis intrapetiolaribus oblongis ad medium usque bifidis, novellis 1.5 cm. longis, maturitate apice caduco, parte relicta ± 5–7 mm. longa, obtusa, demum subreflexa; foliis 9–15 cm. longis, 1.5–3 cm. latis, oblanceolatis, apice acutis, basi sensim in petiolum 1–2 cm. longum attenuatis, coriaceis, nervis lateralibus utrinsecus 7–9, utrinque manifestis, obliquis; alveolis interclypeolaribus spinis clypeolorum plane obtectis; floribus in fundo alveolorum, bracteis intus pilosis involucratis; calyce cupulari truncato membranaceo, 3 mm. longo; corollae tubo (maturo 12 mm., in alabastro 8 mm. longo) intus circa medium et sub antheras annulato-piloso, inter antheras sparsim piloso, lobis 4 mm. longis, oblongis acutis, 1 mm. infra apicem membranaceo-uncinulatis; staminibus versus tubi apicem insertis, antheris in alabastro 2.5 mm. longis; disco concavo; stylo 6 mm. longo; stigmate 4–6-partito, lobis crasse linearibus vix 2 mm. longis; ovario 4–6-loculari.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9445* (TYPE), Aug. 1938, alt. 3225 m., associated with no. *9445,* often on the same tree, and very similar in general appearance, less common than no. *9445* and very seldom terrestrial (only two plants seen) (tuberous stem and branches gray-black, the branches very bristly; leaves concave, the margins not recurved, the midrib rounded below [before drying]; flowers white, the anthers blue).

Although the fineness of the spines, the similar leaf-outline, and the same general habit suggest *Myrmecodia Lamii,* the very fine slender spines or coarse bristles developed so abundantly on the stems or branches at once suggest a difference. The clypeoli are not nearly so obvious as in the other species, and the stipules are of the regular type, intrapetiolar, and at the base they do not appear to extend beyond the point of insertion of the petiole. The floral characters too are distinctive; the rather broad band of hairs at about the middle of the corolla-tube within and just below the stamens shows a tendency to extend upward between the anthers, while the stigmatic lobes are linear.

Myrmecodia sterrophylla sp. nov.

Tuber costatum, spinosum, spinis 5–15 mm. longis saepissime simplicibus; caulibus cum spinis circiter 4 cm. diametro, versus apicem foliosis, clypeolatis; clypeolis 10–13 mm. longis, 10 mm. latis, prope marginem dense spinosis, spinis 10(–15) mm. longis; stipulis lanceolatis, 1 cm. longis, profunde bifidis apice paulo divergentibus; foliis oblongo-lanceolatis, 14–27

cm. longis, 4–6 cm. latis, utrinque fere aequaliter angustatis, apice sensim acuminatis, basi in petiolum 2–5 cm. longum attenuatis, valde coriaceis, margine crispis planis, nervis lateralibus utrinsecus 8 vel 9 utrinque subprominulis; alveolis elongatis interclypeolaribus spinis clypeolorum obtectis; floribus seriatim in fundo alveolorum, bracteis intus pilosis involucratis; calyce (alabastro) 2 mm. longo, cupulari, truncato; corollae tubo infra stamina annulum tomentosum ferente; antheris 3 mm. longis; stigmate 6-lobato, lobis lineari-oblongis; fructibus oblongis; pyrenis 6, circiter 4 mm. longis.

Netherlands New Guinea: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12138* (type), Jan. 1939, alt. 1800 m., common as a high epiphyte in mossy forest (leaves somewhat concave, the margins crinkled; flowers white; fruit red).

Superficially this specimen very closely resembles *Brass 12047,* but the flowers definitely indicate a different species. In some ways it suggests *Myrmecodia longifolia* Val., but the leaves are clearly lanceolate and not somewhat long-acuminate.

Myrmecodia Archboldiana sp. nov.

Tuber costatum, dense spinosum, circiter 30 cm. longum, 16 cm. diametro; spinis 5–15 mm. longis e cortice stellatim fasciculatis vel interdum a basi ramosis vel simplicibus, gracilibus; caulibus (cum spinis) 2.5–4 cm. diametro, versus apicem foliosis, clypeolatis; clypeolis ± 10 mm. longis, 8–9 mm. latis, margine dense spinosis, spinis 1–2 cm. longis; stipulis ± 5 mm. longis cito caducis; foliis 20–29 cm. longis, 2.5–4 cm. latis, linearilanceolatis, apice acutis vel subacuminatis, basi sensim in petiolum 4–9 cm. longum attenuatis, tenuiter coriaceis, nervis lateralibus utrinsecus 12–15 supra manifestis interdum prominulis, subtus manifestis, margine planis; alveolis interclypeolaribus elongatis spinis clypeolorum plane obtectis; floribus in fundo alveolorum, bracteis involucratis verisimiliter intus glabris; calyce cupulari brevi truncato membranaceo 1–1.5 mm. longo; corollae tubo 16 mm. longo, intus glabro, versus basim 5 mm. membranaceo sursum crassiusculo; lobis 5 mm. longis, acutis, vix uncinulatis; staminibus in apice tubi insertis, antheris 3 mm. longis; disco plano; stylo 9 mm. longo; stigmate 2–4-lobato, lobis crassiusculis; ovario 2–4-loculari; pyrenis brevibus, circiter 3 mm. longis.

Netherlands New Guinea: Bele River, 18 km. northeast of Lake Habbema, *Brass 11216* (type), Nov. 1938, alt. 2200 m., common on oaks in primary forest and also occurring on various trees in secondary forest (stock bottle-shaped, irregularly ridged and very spiny; typical example 30 × 16 cm.; petiole and midrib orange-colored; flowers white); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12047,* Jan. 1939, alt. 1800 m., common epiphyte in mossy forest (petioles bright orange-red; flowers white).

This species may resemble *Myrmecodia longifolia* Val. somewhat in habit, but the spines on the tuberous stem are longer and tend to be fascicled or stellate from the base rather than short and simple; the leaves are different in outline; there do not appear to be any hairs or filaments in the bracts of the alveoli, and the flower is glabrous, the corolla lacking the common annular pilosity within.

Myrmecodia erinacea Becc. Malesia 2: 105. *t. 12, fig. 7–11.* 1884; Valeton, Nova Guin. 8: 514. 1911, Bot. Jahrb. 61: 145. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13934,* alt. 50 m., April 1939, common low epiphyte in flooded rain-forests of river-plain (leaves convex and much crinkled; flowers greenish blue).

The species has been reported twice for Netherlands New Guinea, once from the island of Japen, the other from southwestern New Guinea, both times growing on *Rhizophora;* this collection indicates that the species extends inland as well as occurring on the coast.

Myrmecodia prolifera sp. nov.

Tuber ecostatum, ± oblongum, usque 13 cm. longum et 5 cm. latum, spinosum; spinis prope basim ramosis, basi 1–1.5 mm. ramis 5 mm. longis, pungentibus; caulibus 1.2 cm. (cum spinis 3.5 cm.) diametro, spinis usque 2 cm. longis saepissime simplicibus interdum pauciramosis; clypeolis indistinctis vel confluentibus, spinis interdum sub basi petioli instructis; stipulis cito caducis; foliis 10–17 cm. longis, 1.5–4 cm. latis, oblanceolatis vel oblongo-spathulatis, apice subabrupte acutis vel breviter acuminatis, basi sensim in petiolum 2–4 cm. longum leviter alatum elongato-attenuatis, pergamaceis, nervis lateralibus utrinsecus 6–9 patenti-arcuatis, supra manifestis subtus prominulis, margine planis vel in sicco versus basim leviter revolutis; alveolis oblongis spinis densissime obtectis; bracteis intus glabris vel sparsim pilosis, involucratis; calyce brevi cupulari truncato circiter 1.5 cm. longo; corollae tubo in parte inferiore annulato-barbato; staminibus in apice tubi insertis; stylo circiter 7 mm. longo; stigmate 4-partito, lobis linearibus; fructibus ut videtur in alveolis germinantibus.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13935* (TYPE), April 1939, alt. 50 m., common in open swamp-forests of river-plains (leaves convex, petioles white; flowers greenish blue).

This species, in the outline of the leaves, the four linear stigmatic lobes, and the ring of hairs inside the corolla-tube, suggests *Myrmecodia alata* Becc. It lacks the costate character of the tuberous stem and has definitely branched spines on the tuber and occasionally forked or twice-branched spines on the stem; the clypeoli appear to be continuous or obliterated except for the leaf-scars; the stem-spines are mostly clustered according to the position of the alveoli.

Myrmecodia paucispina Val. Bot. Jahrb. 61: 150. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13829,* April 1939, alt. 50 m., epiphytic in open swamp forest, rare (tuberous stem irregularly ovoid). BRITISH NEW GUINEA: Auga River, Mafulu, *Brass 5496,* Nov. 1933, alt. 580 m., epiphytic on river-bank trees, common (large unevenly swollen tuberous base frequently lobed or branched, the surface swellings only armed with prickles around and amongst which are entrance holes into interior galleries inhabited by small black ants; leaf-bearing branches quadrangular; flowers and fruit in deep pits; flowers white; fruit elongated, pale yellow).

On account of the fragmentary material which Valeton had at his disposal, his description of this species is somewhat difficult to place, yet there are sufficient characters given so that we have hesitated to place this material elsewhere at present. The collections agree with the original in the following features: thick four-sided stem with short internodes, the midrib of the leaf decurrent to form a small wing down the stem (not obvious in all specimens but clearly distinct in some), the general outline

of the leaf, the practically naked branch, the fairly large uncinule of the corolla-lobes in bud, and the ring of hairs below the anthers. The specimens differ in having 4 pyrenes, and there are no small fascicled rootlets on the lower angles of the stem, nor are there any spines (Valeton does not say whether the spines are simple or branched) on the margins of the lower alveoli. There are occasional branched spines on the lower parts of the stem; the tuberous base has both single and branched spines but mostly branched, and in the latter the branches are often again branched, as in *Myrmecodia Albertisii* Becc., but the spines are somewhat coarser and more rigid. The leaves in these collections are about 12–28 cm. long, 4–8(–10) cm. broad, and strongly resemble that pictured by Beccari for *Myrmecodia alata*.

Myrmecodia Albertisii Becc. Malesia 2: 112. *t. 11.* 1884.

British New Guinea: Wuroi, Oriomo River, *Brass 5848,* Feb. 1934, alt. 10–30 m., hanging from branches of savanna trees, abundant (a thick, often branched stem growing from an elongated large swollen and very spiny base [typical base 50 × 23 cm.]; flowers bluish white, fleshy; fruit pale yellow, 10 × 6 mm., soft); Lake Daviumbu, Middle Fly River, *Brass 7599,* Aug. 1936, plentiful on low trees of lake-shore (flowers bluish white); Tarara, Wassi Kussa River, *Brass 8580,* Dec. 1936, very common savanna-forest epiphyte (stems and tuberous base very thorny; flowers bluish white).

The last collection has the long-styled flower pictured by Beccari; the others have short-styled flowers, the band of hairs being about one-third the length of the tube above its base, and the stamens attached to the apex of the tube; there does not seem to be any other essential difference. We take this to be an example of heterostyly in this species.

Myrmecodia salomonensis Becc. Malesia 2: 175. *t. 53, fig. 1.* 1884; Guppy, The Solomon Islands and their Natives, 297. 1887; Valeton, Bot. Jahrb. 61: 150. 1927. Pl. I, fig. D.

Solomon Islands: San Cristoval: Waimamura, *Brass 2585,* Aug. 1932, common, epiphytic on trees fringing rivers and the sea beach (pendulous under the branches of the host tree; lower tuberous part of stem elongated, marked with numerous small pits and tubercles; typical large specimen 45 cm. long, 16 cm. diameter at middle; leaf-bearing part of stem 60 cm. long, 4 cm. diameter, curved upward with a crown of thick glabrous leaves arranged in spirals [on account of the twisting of the stem]; corolla white, 4-angled, fleshy; a few young seedlings often rooting and growing in the bristly depressions between the leaf-rows; cavities in tuberous stem inhabited by colonies of small brown ants).

Beccari's original description is based on a leaf without a petiole, a fragment of a tuberous stem, and Guppy's notes. Guppy says the species is "noticed commonly on tall mangrove trees bordering the sides of streams in the lower part of their courses." Although the leaves of the specimen cited above are somewhat shorter (26 × 10–11 cm.) than that of the original, there can be little doubt that the two belong to the same species.

Clypeoli irregularly oblong, with spines mostly on the margins, the spines ± 10(–20) mm. long. Petioles ± 18 cm. long. Flowers in the alveoli between the clypeoli; calyx membranous, annular, 2 mm. long; corolla before anthesis 14 mm. long, 3.5 mm. diameter, within about 2 mm. above the base annular-villous, the lobes about 3 mm. long; anthers 2.5 mm. long; style 12 mm. long, the stigma indistinctly lobed; fruit 6-seeded.

Myrmecodia pendens sp. nov.

Tuber costatum spinosum, spinis 7–15 mm. longis, gracilibus, simplicibus vel interdum ramosis; caulibus (cum spinis) circiter 3.5 cm. diametro, versus apicem foliosis, indistincte clypeolatis; clypeolis sub insertionem petioli spinas 10–12 mm. longas gerentibus; stipulis ± 1 cm. longis, bifidis, intrapetiolaribus, lobis paulo divergentibus; foliis usque 20 cm. longis et 5 cm. latis, oblongo-oblanceolatis, versus apicem sensim acuminatis, basi sensim in petiolum usque 2 cm. longum attenuatis, pergamaceis vel tenuiter coriaceis, nervis lateralibus utrinsecus ± 11 utrinque subprominulis, venis interspersis; alveolis interclypeolaribus spinis clypeoli obtectis; bracteis intus pilosis involucratis; floribus in fundo alveolorum; calyce cupulari, 1 mm. longo, truncato; corollae tubo 1.3 cm. longo, 4 mm. supra basim dense annulato-piloso, lobis oblongis, ± 5 mm. longis, infra apicem 1 mm. uncinulatis; antheris in apicem tubi insertis, 3 mm. longis; disco plano; stylo circiter 9 mm. longo, stigmate indistincte lobato; ovario 4-loculari; fructibus elongatis; pyrenis 3–4 mm. longis.

BRITISH NEW GUINEA: Mafulu, *Brass 5401* in part (TYPE in Arnold Arb.), Nov. 1933, alt. 1250 m., lower primary forest junction with oak forest, i. e. upper edge of mixed rain-forest (upward of 50 plants pendent from branches of a tall tree; flowering plants 20 to 60 cm. long; tuberous base of largest plant 23 cm. long, 10 cm. greatest diameter, flanged and armed with prickles; leaves dark, smooth, with whitish midrib; flowers white; fruit orange-yellow, shining; smallest plant contained in upper cells a lining of soft white tissue — no ants; other plants inhabited by numerous small brown ants).

The two collections of this number which we have at hand show so much variation that it has seemed best at present to describe both as new species; unfortunately the other duplicates are unavailable for examination. The above type sheet consists of a leaf-bearing stem and a cross-section of a tuberous base; the latter is approximately 8 cm. in diameter, closely costate, and armed with slender, simple, and only very occasionally branched spines. The stem is about 15 cm. long, thickly beset with stouter simple spines and here and there spines with 1–3 branches. In the flower the stamens are at the apex of the tube, but the style is long enough so that the stigma is located in the midst of the opening anthers; the flowers examined have four locules. The other specimen (New York Bot. Gard.) has a tuberous base covered with branching spines; the stem also has branching spines around the alveoli forming a sort of protective cover, and the clypeoli are more or less confluent around the alveoli with occasional branching spines, but the stem does not give the impression of being densely spiny as in the other specimen; in the flower the anthers are low in the corolla-tube, and the style is just long enough to hold the stigma in the region of the anthers; the ovary is six-loculed and there are only very small tufts of hairs in the corolla below the stamens.

Myrmecodia pendula sp. nov.

Tuber costatum spinosum, oblongum, 15 cm. longum, 5 cm. diametro; spinis ramosis, basi 1–2 mm. longa, ramis 5–7 mm. longis; caulibus (cum spinis) 3 cm. diametro, versus apicem foliosis, clypeolis confluentibus consperse spinosis, spinis ramosis, ± 7 mm. longis; stipulis circiter 1 cm. longis cito caducis; foliis usque 11 cm. longis et 2.5 cm. latis, anguste oblanceo-

latis, apice acuminatis, basi sensim in petiolum 1.5 cm. longum attenuatis, tenuiter coriaceis, nervis lateralibus utrinsecus ± 8 supra manifestis, subtus inconspicuis, venis interspersis; alveolis breviter oblongis margine dense spinosis, spinis ramosis; floribus in fundo alveolorum; bracteis involucratis intus dense pilosis, pilis fuscis; calyce cupulari 3 mm. longo; corollae tubo 7 mm. longo, intus paulo infra stamina sparsim barbato; lobis fere 2 mm. infra apicem uncinulatis; staminibus in medio tubo insertis; stylo brevi; ovario 6-loculari; fructibus ovoideis; pyrenis ± 3 mm. longis.

British New Guinea: Mafulu, *Brass 5491* in part (type in New York Bot. Gard.), Nov. 1933, alt. 1250 m., lower primary forest junction with oak forest, i. e. upper edge of mixed rain-forest (upward of 50 plants pendent from branches of a tall tree; flowering plants 20–60 cm. long; tuberous base of largest plant 23 cm. long, 10 cm. greatest diameter, flanged and armed with branching prickles; leaves dark, smooth, with whitish midrib; flowers white; fruit orange-yellow, shining; smallest plant contained in upper cells a lining of soft white tissue — no ants; other plants inhabited by numerous small brown ants).

The distinctive characters of this species are the branching spines of both the tuberous base and the stem, the somewhat confluent clypeoli, the rather obviously uncinulate corolla-lobes, the bud tapering toward the apex, the anthers low in the tube, beneath them the very scanty tufts of hairs, the short style, and the 6-loculed ovary. Both *Myrmecodia pendens* and *M. pendula* were collected from the same branch and were intended to show variation; the photograph shows "detached plants hanging by the long roots by which they dangled in their treetop home."

Nertera Banks and Solander

Nertera granadensis (Mutis) Druce, Rep. Bot. Exch. Cl. Brit. Isles **1916**: 637. 1917.
Gomozia granadensis Mutis ex Linn. f. Suppl. 129. 1781.
Nertera depressa Banks & Solander ex Gaertn. Fruct. **1**: 124. *pl. 26*. 1788.
Nerteria depressa Smith, Ic. Ined. **2**: 28. *t. 28*. 1790.
Nertera depressa var. *papuana* Valeton, Bot. Jahrb. **61**: 156. 1927.

Netherlands New Guinea: 5 miles northeast of Wilhelmina-top, *Brass 9398*, alt. 3440 m., mossy banks of grassland stream; Lake Habbema, *Brass 9476*, alt. 3225 m., on mossy tree in edge of forest; 9 km. northeast of Lake Habbema, *Brass 10548, 10623*, alt. 2800 m., prostrate and creeping in stony bed of stream in forest, also creeping on log in native rest clearing; 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12392*, alt. 1500 m., creeping in moss on wet rocks of waterfall; Angi, Arfak Mountains, *Kanehira & Hatusima*, without field number, alt. 1900 m., April 1940, in mossy forest along the track from Momi to Lake Gita. British New Guinea: Mount Tafa, *Brass 5020*, alt. 2400 m., common in open places on roadside banks. Fruit fleshy, red.

There is a good deal of variation in the leaf-outline of the collections included under this species. In view of the variations already admitted in the specific concept, it is questionable whether var. *papuana* is sufficiently distinct to maintain or not. The genus needs a monographer's careful study. This record is made to call attention to the earlier but less commonly used specific name. Sir James Smith's description was based on the specimen and manuscript of Mutis.

Nertera nigricarpa Hayata, Jour. Coll. Sci. Tokyo 25(Art. 19): 115. 1908, Icon. Plant. Formos. **7**: 32. *pl. 6*. 1918.

Netherlands New Guinea: 5 miles northeast of Wilhelmina-top, *Brass 9397*, Aug.

1938, alt. 3440 m., mossy banks of grassland stream (fruit black, laterally compressed); 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10382,* Sept. 1938, alt. 3700 m., under shrub in wet rocky place (fruit black, glossy).

The New Guinean material is slightly smaller than that described from Formosa and the leaves are a little shorter-petiolate, but we believe that the collections belong in this species. All previous records have been from Mount Morrison, Formosa. This is the second genus which we have found common to these two regions, the other being *Stellaria* (*S. saxatilis* Buch.-Ham.), cf. Jour. Arnold Arb. 23: 386. 1942.

Borreria G. F. W. Meyer

Borreria Baileyana (Domin) comb. nov.

Spermacoce Baileyana Domin, Bibl. Bot. 22(Heft 89^{vii}): 1182(628). 1929.

Spermacoce pogostoma Benth. var. *hispida* F. M. Bail. Bot. Bull. 4: 11. 1891 (Dept. Agric. Bull. no. 13).

BRITISH NEW GUINEA: Dagwa, Oriomo River, *Brass 5934,* Feb. 16, 1934, alt. 40 m., common on open grassy ridges (slender erect herb with pale purple flowers); Daru Island, *Brass 6388,* abundant grass associate in savanna forests (flowers white).

Although we have no material for comparison, these collections seem to agree reasonably well with the description of the collections from the Cape York Peninsula, Queensland, and such a range could very well be expected.

Borreria papuana (F. v. Muell.) comb. nov.

Spermacoce papuana F. v. Muell. Descr. Notes Papuan Pl. 1: 27. 1876.

BRITISH NEW GUINEA: Lake Daviumbu, Middle Fly River, *Brass 7540, 7817,* Aug. 1936, plentiful on savannas (flowers white); Tarara, Wassi Kussa River, *Brass 8572,* Dec. 1936, savanna forest, rare (flowers blue).

Valeton, Nova Guin. 8: 516. 1911, mentioned that this species belonged to *Borreria* but did not actually make the combination. The type of the species was collected on the Mai Kussa or Baxter River, so that the last cited collection might almost be considered a topotype. It is a rather distinct species with very long seta-like calyx-lobes and long corolla.

Borreria laevis (Lam.) Griseb. Fl. Brit. West Ind. 349. 1861; Merr. Philip. Jour. Sci. 60: 34. 1936.

Spermacoce laevis Lam. Tabl. Encycl. 1: 273. 1791.

NORTHEAST NEW GUINEA: Marienberg, Sepik River, *Herre 238,* May 1929, riverbank. NEW BRITAIN: Kokopo, *Herre 173,* April 1929, cultivated land near seashore.

A cosmopolitan weed apparently spreading rapidly. In addition to the range cited by Merrill, records have been listed from Fanning Island and Niue Island.

Borreria linearis sp. nov.

Planta prostrata; caulibus repentibus, basi suffrutescentibus, ramosis, tetragonis, internodiis 1–2 cm. longis; ramis erectis, internodiis 4–15 mm. longis, sub nodis interdum scabridulis; foliis sessilibus coriaceis linearilanceolatis, 5–10 mm. longis, 2 mm. latis, acutis, basi angustatis, margine revolutis, versus apicem consperse scabridulis, nervo medio supra impresso, subtus prominente; stipulis membranaceis puberulis, vaginantibus, margine interfoliaceo sursum arcuato, laciniis setosis 2–4 mm. longis, circiter 4–6 et

interdum brevioribus interjectis instructo; floribus glomerulatis, axillaribus et terminalibus; floribus et setoso-bracteis intermixtis; ovario obconico, 1 mm. longo, calycis lobis 4 linearibus, basi puberulis; corolla infundibuliformi, 2 mm. longa, tubo glabro, lobis obtusis, brevibus, 0.5 mm. longis, staminibus in apice tubi insertis; stylo glabro; stigmate bidentato; fructibus 1.5 mm. longis, leviter latioribus; calycis lobis persistentibus coronatis; seminibus 1 mm. longis, oblongis, brunnescentibus, minute punctulatis.

British New Guinea: East Mount Tafa, *Brass 4067* (type), May 1933, alt. 2350 m., common on a small burnt-over clearing in mossy forest (small prostrate plant with white flowers). Northeast New Guinea: On the ridges of Finisterre Mountain, *Schlechter 18224,* Sept. 1908, alt. 1200 m.

This species has been taken for *Borreria brachystema* (R. Br.) Val., but the latter has the stamens "on very short filaments at the base of the tube," whereas in *B. linearis* the stamens are inserted at the orifice of the corolla-tube and alternate with its lobes. There is very little pubescence on the plant, the stipular sheath being usually covered with minute hairs and often the region just below the node, but if this is glabrous usually the elevated lines which run down the angles of the stem are pubescent in the vicinity of the nodes. The upper part of the fruit is often sparsely pubescent as well as the lower part of the calyx. Although cystoliths are not visible in the dried plant, when a small part has been thoroughly soaked in water the lower surface of the leaves and sometimes the flowers show the presence of cystoliths; they are also present on the inner face of the seed.

Borreria lanceolata sp. nov.

Planta erecta, basi suffrutescens; caulibus ramosis, tetragonis, internodiis 1–2.5 cm. longis glabris; foliis subsessilibus subcoriaceis, lanceolatis 7–15 mm. longis, 2–3 mm. latis, apice acutis, basi rotundatis, margine revolutis, utrinque glabris, nervo medio supra impresso, subtus prominente fere carinato; nervis lateralibus utrinsecus 3 vel 4, supra obscuris, subtus inconspicuis; stipulis membranaceis puberulis, vaginantibus, margine interfoliaceo sursum arcuato, laciniis setosis 2–3 mm. longis, circiter 6 instructo; floribus glomerulatis, axillaribus et terminalibus, floribus et setoso-bracteis intermixtis; ovario obconico pubescente, 1 mm. longo; calycis lobis 4 lineari-lanceolatis ciliolatis, versus basim pubescentibus; corolla infundibuliformi, tubo extus puberulo, intus glabro, lobis obtusis circiter 0.8 mm. longis intus puberulis; staminibus in apice tubi insertis; stylo glabro; stigmate bidentato; fructibus 1.5 mm. longis, calycis lobis persistentibus coronatis (incl. calyce 3 mm. longis); seminibus 1 mm. longis, oblongis, brunnescentibus, minute punctulatis.

Netherlands New Guinea: Balim River, *Brass 11644, 11737* (type), Dec. 1938, alt. 1600 m., deforested slopes, stony grassland (flowers white).

Borreria lanceolata is closely related to *B. linearis;* it differs in its erect habit, lanceolate leaves, and slightly larger flowers with corolla-lobes definitely pubescent on the upper surface. The laciniae of the stipules do not appear to be quite so long as in the related species, and there is no sign of pubescence on the leaves; whether these differences are brought about by differences in altitude would be difficult to determine without further collections.

Mitracarpus Zuccarini[1]

Mitracarpus hirtus DC. Prodr. 4: 572. 1830?

Mitracarpus villosus (Sw.) DC. Prodr. 4: 572. 1830 (as *Mitracarpum villosum*); Fawcett & Rendle, Fl. Jamaica 5: 127. *fig. 39.* 1936.

BRITISH NEW GUINEA: Laloki River, Rona, *Brass 3559,* March 1933, alt. 450 m., common grassland herb; Kanosia, *Carr 11043,* open places, sea-level.

This is the plant currently passing as *Mitracarpus hirtus* (L.) DC. in the herbarium and in literature, although de Candolle does not make any reference to Linnaeus' species. Both *M. hirtus* and *M. villosus* (as *Mitracarpum hirtum* and *M. villosum*) were based on Swartz's species, and both were from Jamaica, in the West Indies. It is a little puzzling to try to understand why Fawcett and Rendle entirely ignored the disposition of *M. hirtus* in accepting *M. villosus,* in view of the fact that both were described from Jamaica and the former occupies fully as much space in literature as the latter, if not more.

EXPLANATION OF PLATE I

FIG. A. *Myrmecodia Brassii* Merr. & Perry (*Brass 9445*), epiphytic on *Podocarpus compacta* Wasscher; showing the two types of spines on the tuberous base. FIGS. B, C. *M. Brassii,* epiphytic on *Libocedrus.* FIG. D. *M. salomonensis* Becc. (*Brass 2585*), detached from host tree, but showing pendent habit. FIG. E. *M. Lamii* Merr. & Perry (*Brass 9445*), growing terrestrially on bare sandstone.

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[1] For the benefit of other workers who may be as curious as ourselves to learn why the generic name first appears in botanical publications as *Mitracarpum* Zucc., and later as *Mitracarpus* Zucc., we append the following reference: A Gray, Synopt. Fl. North America 1(2): 32. 1884.

Plantae Papuanae Archboldianae, XV

THE COMPARATIVE MORPHOLOGY OF THE WINTERACEAE VII. SUMMARY AND CONCLUSIONS

I. W. Bailey and Charlotte G. Nast

INTRODUCTION

In preceding numbers of this series (1–5, 10), we have described the floral and vegetative morphology of the Winteraceae. The data presented in these papers, together with Smith's (12, 13, 14) taxonomic treatments, provide the basis for a critical evaluation of available evidence regarding the composition, relationships, and phylogenetic significance of the family.

As now constituted, the family is composed of six genera: (1) *Drimys* J. R. & G. Forst., with 40 species in America (Mexico to Cape Horn and Juan Fernandez), Tasmania, Australia, New Guinea, Amboina, Celebes, Borneo, and the Philippines, (2) *Bubbia* v. Tiegh., with 30 species in New Guinea, Queensland, New Caledonia, and Lord Howe Island, (3) *Belliolum* v. Tiegh., with 8 species in New Caledonia and the Solomon Islands, (4) *Pseudowintera* Dandy, with 2 species in New Zealand, (5) *Exospermum* v. Tiegh., with 2 New Caledonian species, and (6) *Zygogynum* Baill., with 6 species in New Caledonia. The number of species in each genus, as outlined above, will doubtless be subject to future revision, since it is probable that the family will gain new members, especially in the genera *Drimys* and *Bubbia*, as the exploration of New Guinea progresses. The family now contains about 88 species, and one may anticipate that this number will eventually be increased to well over 100. The Winteraceae, therefore, instead of being the small group which only recently was dismissed as an inconsequential appendage of the Magnoliaceae, are seen to be a family of considerable consequence both in size and in geographic extent.

MORPHOLOGICAL CHARACTERISTICS

The Winteraceae are characterized as a family by their distinctive pollen, vesselless xylem, and curiously occluded stomata, and by combinations of cauline, floral, and foliar characters that are not duplicated in other dicotyledonous families.

Xylem. The xylem of the Winteraceae is of a structurally unique type among extant representatives of the angiosperms, the woods even of the similarly vesselless *Trochodendron* and *Tetracentron* having significant differences in their rays, wood parenchyma, and other structural features. Although the xylem of the Winteraceae is distinctive, it exhibits certain trends of structural specialization within the family, leading for example toward reduction or elimination of wood parenchyma in Sect. *Wintera* of *Drimys*, toward excessively widened multiseriate rays in *Pseudowintera*, and toward reduction of cell size, particularly in dwarfed or microphyllous species, in Sect. *Tasmannia* of *Drimys*.

LEAF. The lower epidermis of winteraceous leaves is characterized by having a more or less extensive alveolar modification of the cuticle which differs from the waxy layers of other angiospermic leaves, in its higher melting point and insolubility in boiling alcohol, hot ether, and other nonpolar solvents. The alveolar material forms more or less massive deposits in the oval or circular depressions in which the stomata are situated, covering the guard cells and occluding the orifice. Although "plugged" stomata have been reported, Wulff (17), in various monocotyledons and dicotyledons, the particular morphological and chemical expressions of the phenomenon in the Winteraceae appear to be distinctive of the family.

The mode of insertion of the foliar vascular tissue in the eustele is stereotyped and stable throughout the Winteraceae, being prevailingly of the so-called trilacunar type. On the contrary, the patterns of vascularization within the petiole and lamina are diverse and variable within certain specific limits. Two trends of specialization are discernible in *Drimys,* leading (1) toward division of three foliar strands to form more or less numerous derivative bundles, and (2) toward fusion of foliar strands to form a single arc-shaped vascular bundle. The former trend of specialization is intensified in *Belliolum* and *Bubbia* and attains its climax in *Exospermum* and *Zygogynum.*

INFLORESCENCE. The inflorescences of the Winteraceae exhibit a wide range of morphological variability. In *Drimys* they are clearly axillary or intercalary on monopodially elongating axes, whereas in *Bubbia, Belliolum, Exospermum,* and *Zygogynum* they are terminal or "pseudoterminal" on sympodially elongating shoots. In *Pseudowintera* the inflorescences are apparently terminal or "pseudoterminal" on sympodial axillary short shoots of a monopodially elongating vegetative axis. The individual inflorescences of different representatives of the family exhibit numerous transitions between complexly branched, many-flowered, cyme-like types and single-flowered ones that may be either axillary (*Drimys*) or terminal (*Zygogynum*). These numerous transitional types of inflorescences are suggestive of phylogenetic series either of reduction or amplification.

According to Parkin (11), the pseudoterminal inflorescences of such genera as *Bubbia* and *Belliolum* developed from an intercalary type by the abortion of the terminal bud. In other words, a group of axillary inflorescences is congested at the apex of the stem, and the structure as a whole appears to be terminal because the apical bud is suppressed or absent. It should be emphasized in this connection, however, that if the pseudoterminal inflorescences of *Bubbia, Belliolum, Exospermum,* and *Zygogynum* are derived from intercalary ones as of *Drimys,* the terminal single flowers of certain species of *Zygogynum* must represent the end of a reduction series. There is much in the comparative morphology of the Winteraceae as a whole to justify such a conclusion.

PERIANTH. The flowers of the Winteraceae are characterized by having a combination of gamosepaly and polypetaly, together with a strong tendency toward reduction in the number of constituent parts both of the calyx

and corolla. Variations in the number, size, form, and texture of the petals are of specific rather than generic significance. On the contrary, the calyptrate calyx of *Drimys* serves to differentiate this genus from the other genera of the family, which have rotate or variously lobed calyces that do not enclose the buds.

Stamens. The microsporophylls of the Winteraceae are of three distinct morphological types. Four of the genera, *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum,* have short, comparatively broad, more or less truncated or apically flaring microsporophylls. The more or less protuberant sporangia are attached to the broad apex of these sporophylls and are oriented either transversely or in various diagonal positions. *Belliolum* is characterized generically by having apically tapered microsporophylls and particularly by having laterally attached sporangia oriented parallel to the long axis of the sporophyll. In these five genera, the sporophylls are not differentiated into filament, anther, and connective, and the sporangia are not excessively protuberant. The microsporophylls of *Drimys* fluctuate considerably in length and breadth, not only in different species, but also within the same flower. They are characterized, however, by having markedly protuberant thecae that are attached to the much constricted upper part of the sporophyll. The microsporophylls of Sect. *Wintera* are relatively broad, but those of Sect. *Tasmannia* are at times much elongated and narrow. The latter are more typically stamineal, exhibiting differentiation into filament, connective, and anther. Our comparative investigations of microsporophylls in other ranalian families suggest that there are two trends of morphological specialization in the Winteraceae, leading in *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum* to the formation of broadly truncated sporophylls bearing transversely oriented apical sporangia, and in *Drimys* to apically constricted sporophylls bearing markedly protuberant, laterally attached, subapical sporangia.

Pollen. Throughout the family the pollen is associated at anthesis in permanent tetrahedral tetrads, each pollen grain having a distally oriented germ pore and a characteristically reticulate exine, the reticulations being composed of more or less extensively coalesced rods. The tetrads are unlike those of the Lactoridaceae and of certain representatives of the Annonaceae, Monimiaceae, and Nymphaeaceae, and are morphologically unique among families of ranalian affinities. Two obvious trends of specialization in pollen morphology are discernible, however, within the Winteraceae, leading to the formation of (1) a minutely, rather than a coarsely, reticulate exine in *Exospermum* and *Zygogynum,* and (2) in Sect. *Wintera* of *Drimys,* tetrads having four conspicuously protuberant papillae when dried pollen is re-expanded in water or lactic acid.

Carpels. The salient trends of carpellary specialization within the Winteraceae are distinct and obvious. The carpels of Sect. *Tasmannia* of *Drimys* are conduplicate megasporophylls having a stipe and an adaxially folded lamina, with a deep slit-like opening that extends inward to the

longitudinally oriented locule. The free margins and adjacent surfaces of the open conduplicate megasporophyll are provided with glandular hairs. In other words, the carpels have conspicuous stigmatic crests (actually double) which extend from the region of the stipe along the conduplicate adaxial parts of the sporophyll and slightly overtop its apex. When spread open, the lamina exhibits a palmately 3-veined vascularization, and the more or less numerous anatropous ovules are attached in longitudinally oriented series between the dorsal and ventral veins. The ovules are vascularized in part by short branches of the two ventral veins, in part by branches of the dorsal vein, and in part by strands originating near anastomoses of the ventral and dorsal vascular systems, the proportions of the three types of vascularization fluctuating from carpel to carpel. Thus, the ovules are attached not to the margins, but to the adaxial surface of the lamina of the megasporophyll.

The carpels throughout Sect. *Wintera* of *Drimys* have a fundamentally similar conduplicate form, vascularization, and placentation, but the external stigmatic crests are restricted to the adaxially projecting subapical part of the megasporophylls. The approximated ventral surfaces of the conduplicate carpels are firmly concrescent except at the level of the stigmatic crests, and therefore the megasporophylls cannot be unfolded as in the case of the less modified sporophylls of Sect. *Tasmannia*. In other words, with the closure of the cleft-like opening, the conduplicate carpels retract and eventually eliminate the stigmatic crests from the sealed parts of the megasporophyll. Thus, the subapical projection of the Sect. *Wintera* type carpel is not to be interpreted as a style-like outgrowth, but rather as a persistent remnant of the extensive adaxial stigmatic crests of open megasporophylls of the Sect. *Tasmannia* type.

Various transitional stages in the closure of conduplicate megasporophylls and in the restriction of their stigmatic crests occur in *Bubbia*, but in this genus, as in *Belliolum*, *Pseudowintera*, *Exospermum*, and *Zygogynum*, there is in addition a more or less pronounced abaxially directed deformation of the conduplicate megasporophylls. These trends of specialization commonly lead to the formation of carpels having conspicuously broadened and flattened apices with restricted, more or less transversely oriented, and therefore apparently terminal stigmatic crests. In such carpels there are concomitant modifications in the form and orientation of the locule, in the placental surfaces, and in the vascularization of the deformed conduplicate megasporophylls. Owing to these concomitant deformations from longitudinal to curved or transverse orientations, it is evident that the apparently terminal parts of the carpels actually are homologues of the ventral parts of primitive conduplicate megasporophylls of the Sect. *Tasmannia* type. The true apex of the carpel is curved around into a dorsal position. In the case of the syncarpous species of *Zygogynum*, the abbreviated stigmatic crests and the placentation appear to be dorsal. This is due, however, to the fact that a morphologically ventral part of the concrescent sporophylls has been deflected into an abaxial orientation and thus overtops the shortened morphologically dorsal part of the carpel.

Vascularization of bracts, bracteoles, and floral appendages. As previously stated, the vascularization of leaves in the Winteraceae is diversified and variable except in their trilacunar nodal attachments, which are stereotyped and stable throughout the family. In the case of fertile axes, even the vascular attachments of the appendages exhibit more or less extensive ranges of variability. Bracts and bracteoles may have three traces or the vascular strands may be reduced to one. Similarly sepals and petals may have three traces or the traces may be reduced to one or amplified to more than three. Each stamen has a single trace, but its mode of attachment to the toral vascular system is diversified and variable. The carpels may have a concentric or crescent-shaped trace, such as not infrequently occurs in petioles, or three traces, or the traces may be reduced to two or amplified to more than three. Accompanying this diversification of trace number and trace insertion is the occurrence in the flower of an irregular, variable, and complex eustele, which is due to an anastomosing and branching of bundles and the non-association of certain interfascicular regions with traces. The ranges of structural variability within species or genera may or may not overlap. Much additional material must be analyzed, however, before patterns of vascularization, either of the leaf or flower, can be utilized as a basis for sound taxonomic generalizations within the Winteraceae.

COMPOSITION OF THE WINTERACEAE

Various extraneous genera have in the past been assigned to the Winteraceae. All of these with the exception of *Illicium* have subsequently been transferred to more appropriate families. That *Illicium* should be segregated from *Drimys* and its allies and placed in an independent family has been suggested by van Tieghem (15), Diels (8), and McLaughlin (9). There is ample justification for such a procedure. The genus exhibits none of the distinctive characteristics of the Winteraceae and there are no significant similarities in any part of the plant that may be interpreted as indicative of close relationship to *Drimys* and its allies. The pollen is of a fundamentally different structural form, being typically tricolpate. Not only are there numerous vessels in the secondary xylem, but also the multiseriate rays are of a highly modified and much reduced type. The primary vascular cylinder of the stem is of a continuous pseudo-siphonostelic rather than a discontinuous eustelic type. The nodal anatomy and vascularization of the leaf are of a fundamentally different form, being unilacunar instead of characteristically trilacunar. The stomata are not occluded as in the Winteraceae and are of a distinctive morphological type, as are the structural patterns of the cuticle. The vascularization patterns of the torus and floral appendages are unlike those encountered in *Drimys* and its allies. Furthermore, the specializations of the conduplicate megasporophylls have progressed along fundamentally dissimilar lines, leading (1) to constriction of the apical part of the sporophyll and the formation of a style with "decurrent" stigmatic crests, and (2) to reduction of the ovules to one and its localization in the closed, more or less extensively adnate,

basal part of the conduplicate carpel. The calyx is polysepalous, never rotate or calyptrate, and the stamens are of different morphological form. The chromosomes, as Whitaker (16) has shown, differ in size, form, and basic number from those of the Winteraceae. Although *Illicium* is not closely related to *Drimys* and its allies, it exhibits a number of significant similarities to the Schisandraceae. Whether the genus should be included in this family or segregated in an independent family, Illiciaceae, as suggested by van Tieghem (15) and Diels (8), is a problem which will be discussed in detail in a subsequent paper.

With the exclusion of *Illicium,* the Winteraceae become a homogeneous, natural aggregation of obviously closely related plants. The extant representatives of the family exhibit varying combinations of relatively primitive and highly specialized morphological characters, and the surviving genera in all probability represent end products derived from a common ancestry. There are two distinct categories of these genera: (1) *Drimys,* having intercalary inflorescences, calyptrate calyces, normally developed conduplicate carpels, and more stamineal appearing microsporophylls, and (2) *Bubbia, Belliolum, Pseudowintera, Exospermum,* and *Zygogynum,* having terminal or "pseudoterminal" inflorescences, rotate or lobed calyces which do not enclose the buds, carpels which exhibit more or less pronounced abaxial deformation, and microsporophylls that are not typically differentiated into filament, anther, and connective. Within the second category of Winteraceae, *Pseudowintera* is characterized by having terminal or "pseudoterminal" inflorescences on sympodial short shoots and by its much modified and excessively widened multiseriate rays, *Zygogynum* by its strongly developed syncarpy, and *Belliolum* by its apically tapered stamens, which bear laterally attached, longitudinally oriented sporangia, instead of transversely or diagonally oriented ones on a broad apex, as is the case in the other four genera of this category of the Winteraceae. The carpels of *Exospermum* are closely appressed and coherent at anthesis, as in certain species of *Bubbia,* but they are not actually concrescent or syncarpous as in *Zygogynum.* The diffused placentation, highly specialized foliar vascularization, and pollen, which is of the *Zygogynum* type, present serious obstacles to the inclusion of *Exospermum* in *Bubbia* as at present constituted. It should be noted, however, that available collections of *Bubbia, Belliolum, Exospermum,* and *Zygogynum* are so inadequate and the possibilities of additional representatives in unexplored regions so strong that these generic outlines may need future revision.

The Winteraceae are hermaphroditic with perfect flowers except in Sect. *Tasmannia* of *Drimys,* where the plants are dioecious or polygamo-dioecious, the staminate flowers usually bearing sterile carpels and the pistillate flowers being with or without functional stamens. The fertile carpels of Sect. *Tasmannia* (as of certain species of *Bubbia*) are, however, of a more primitive type than the obviously much modified conduplicate megasporophylls of Sect. *Wintera* of *Drimys.* The two sections of *Drimys* also exhibit more or less significant differences in their pollen, foliar sclerenchyma, and secondary xylem.

It is evident that Sect. *Wintera* of *Drimys* cannot have developed directly from Sect. *Tasmannia* or vice versa. In other words, both sections of *Drimys* must have been derived from much less specialized and now extinct ancestral groups. *Bubbia*, *Belliolum*, *Pseudowintera*, *Exospermum*, and *Zygogynum* are obviously more closely related one to another than any one of them is to *Drimys*. Although *Belliolum*, *Pseudowintera*, *Exospermum*, and *Zygogynum* may have developed from *Bubbia*-like ancestors, the five genera cannot be derived directly from *Drimys* or vice versa; they must have diverged from earlier and more primitive Winteraceae, from which the two sections of *Drimys* likewise were independently differentiated.

RELATIONSHIPS

In the past, *Drimys* and its presumed allies, including *Illicium*, have frequently been placed in the Magnoliaceae in a special tribe (Illicieae DC., Wintereae R. Br.) or subfamily (Drimyoideae Harms, Drimydoideae Skottsb.). However, to include such morphologically dissimilar elements as the Winteraceae, *Illicium*, the Schisandraceae, and *Tetracentron* in the Magnoliaceae broadens the concept of this family even beyond the limits of a natural sub-order. The evolutionary gap between the vesselless xylem of the Winteraceae and the relatively highly specialized vessel-bearing wood of *Magnolia*, *Liriodendron*, and allied genera is so great as to preclude any close degree of relationship between the two groups of plants. In addition, there are fundamentally significant morphological differences in the pollen, stamens, carpels, perianth, secondary phloem, nodal anatomy, vascularization of the leaf, stomata, patterns of vascularization of the torus and floral appendages, etc. Furthermore, the reported similarity (Whitaker, 16) in the basic chromosome number, i.e. 19,[1] is not indicative necessarily of close relationship, since the same basic number occurs in such diverse ranalian plants as *Trochodendron*, *Tetracentron*, and *Cercidiphyllum*.

As we have previously shown (6, 7), the Degeneriaceae, Himantandraceae, and Magnoliaceae (sensu stricto) form a compact natural group within the Ranales, the three families being more closely related to each other, on the basis of important morphological characters, than any one of them is to other families. The Winteraceae exhibit no significant evidence of close relationship to this group of families, even the salient trends of carpellary specialization being entirely different. The similarity between the carpels of *Degeneria* and of Sect. *Tasmannia* of *Drimys* is apparently due to the retention of primitive ranalian megasporophylls by plants which exhibit fundamentally different trends of morphological specialization in their flowers, stems, and leaves. Similarly, the vesselless xylems of the Winteraceae, *Trochodendron*, and *Tetracentron* should be interpreted as retentions of primitive vesselless types of ranalian wood by plants which show diverse trends of specialization in their other vegetative characters

[1] The chromosomes of only one of the 88 species of Winteraceae have been studied. In *"Drimys Winteri"* the 2n number is ±76, but this hardly provides a basis for generalization concerning the family as a whole.

and in their reproductive organs. Too much emphasis has been placed in the past upon the mere fact that these plants are vesselless, without due regard to significant structural differences in their xylem. This will be discussed in greater detail in subsequent papers dealing with *Trochodendron* and *Tetracentron*.

Thus, although the Winteraceae obviously are of general ranalian affinities, as evidenced by their secretory cells and other characters, they do not appear to be closely related to any specific surviving family of the ranalian complex.

PHYLOGENETIC SIGNIFICANCE

In the recently described (7) monotypic ranalian family Degeneriaceae, both the stamens and the open carpel appear to be primitive, palmately 3-veined sporophylls of but slightly modified form. The lamina of the megasporophyll is adaxially folded or conduplicate and bears numerous ovules on its morphological upper surface, between its dorsal and ventral veins. In other words, the ovules are not attached to the margins of a classical involute, sealed sporophyll, but to the ventral surface of the megasporophyll as in certain of the Cycadofilicales. The microsporophylls, as in the related Himantandraceae (6), resemble the sterile sporophylls ("staminodia") and are not differentiated into filament, anther, and connective. The two pairs of slender, vertically elongated sporangia are immersed beneath the abaxial surface of the sporophylls and are situated between the median and lateral veins.

The Winteraceae are particularly significant in the study of the comparative morphology and phylogeny of the dicotyledons, not only owing to their retention of a primitive vesselless xylem, but also owing to their retention of extensive transitional series of carpellary structures illustrating successive stages in the closure and morphological modification of primitive, open, conduplicate megasporophylls of the *Degeneria* type. In addition, there are within the family successive steps in the development of more typical stamineal structures which arise apparently by the reduction of broad microsporophylls to slender filament and connective and by concomitant emergence or protuberance of the microsporangia, i. e. thecae. Furthermore, the family exhibits numerous transitions between complex intercalary or "pseudoterminal" inflorescences and simple, single-flowered ones. Since the single terminal flowers of *Zygogynum* appear to be the culmination of a reduction series, it is a question whether the single, large terminal flowers of *Magnolia* may not have originated through similar reductions of a complex ranalian inflorescence. In any case, it is unfortunate that so much attention has been focused upon the Magnoliaceae (sensu stricto) in discussions concerning the origin of the angiosperms, for the seedlings, stems, roots, leaves, stamens, and carpels of these plants all exhibit a relatively high degree of morphological specialization. More primitive and significant ranalian structures are retained by such families as the Winteraceae, Degeneriaceae, Himantandraceae, Trochodendraceae, etc. It should be

emphasized in this connection, however, that each of these families exhibits a combination of primitive and more or less specialized characters, indicative of reticulate rather than linear relationships and of common origin from an ancestral ranalian stock. Until essential fossilized material is discovered, the composite structure of such ancestors can be synthesized only by combining the more primitive features of a number of diverse families.

There is no known species or genus of the Winteraceae, either extant or fossil, from which the rest of the family may have been evolved. Each known surviving member of the family exhibits one or more trends of morphological specialization which exclude any possibility of the plant being ancestral to all of the others. The Winteraceae are obviously an extremely ancient group of dicotyledons, the surviving representatives of which are end products derived from a common ancestry. Many structural features of this hypothetical ancestry can be synthesized from extant species and genera with a high degree of certainty, whereas others must remain for the present more or less speculative or problematical. The following is our concept of such an ancestral winteraceous stock and of its salient trends of morphological specialization:

Habit. Trees or large shrubs. Salient specialization: dwarfing of the entire plant or of its leaves, particularly in certain species of Sect. *Tasmannia* of *Drimys*.

Xylem. Vesselless, with diffuse parenchyma and primitive heterogeneous type I rays. Tracheids large, extremely elongated and provided with a relatively high ratio of scalariform and multiseriate-bordered pitting. Salient trends of specialization: (1) reduction or elimination of wood parenchyma in Sect. *Wintera* of *Drimys*, (2) excessive broadening of multiseriate rays in *Pseudowintera*, and (3) reduction in tracheary size and pitting, particularly in dwarfed and microphyllous species of Sect. *Tasmannia* of *Drimys*.

Leaf. Simple, entire, glabrous, exstipulate, pinnately veined, having numerous ethereal oil cells, characteristically occluded stomata, and three separate traces with trilacunar nodal attachments. Most significant trend of specialization: increasing complexity of vascularization patterns in *Bubbia* and *Belliolum*, culminating in *Exospermum* and *Zygogynum*.

Inflorescence. Plants hermaphroditic, with perfect flowers. Inflorescences probably complex and intercalary, as in Sect. *Wintera* of *Drimys*. Chief trends of specialization: (1) establishment of dioecious or polygamodioecious habit in Sect. *Tasmannia* of *Drimys*, (2) transitions from intercalary to "pseudoterminal" and terminal inflorescences, and (3) reduction of complex inflorescences to simple single-flowered ones.

Calyx. Gamosepalous, with a variable number of lobes. Salient trends of specialization: (1) reduction in the number of partly concrescent sepals to two, as common in *Drimys* and *Pseudowintera*, (2) elimination of the lobes to form entire or rotate calyces, and (3) complete concrescence of sepals to form a calyptrate calyx, as in both sections of *Drimys*.

COROLLA. Polypetalous, with an indefinite number of free petals. Chief trend of specialization: reduction in the number of petals, frequently to two (rarely to one or none) in Sect. *Tasmannia* of *Drimys*.

STAMENS. Numerous, sporophyll-like, and not differentiated into filament, anther, and connective, the sporangia partly embedded in the lamina of the microsporophyll. The exact form of the ancestral microsporophyll is uncertain. If the stamens of *Belliolum haplopus* (Burtt) A. C. Sm. and *B. Pancheri* (Baill.) v. Tiegh. are the least modified of surviving Winteraceae, as seems possible from comparative studies of other ranalian families, then there are two distinct trends of specialization in winteraceous microsporophylls, leading (1) in *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum* to the formation of broadly truncated sporophylls bearing transversely oriented apical sporangia, and (2) in *Drimys* to more typically stamineal structures exhibiting various incipient stages of differentiation into filament, anther, and connective.

POLLEN. In tetrahedral tetrads, each grain having a distally oriented germ pore and a coarsely reticulate exine. Most significant trend of specialization: the development of a minutely reticulate exine in *Exospermum* and *Zygogynum*.

CARPELS. Sporophyll-like, stipitate, with conduplicate, palmately 3-veined lamina, having two closely approximated stigmatic crests which extend from the region of the stipe to the apex of the adaxially folded lamina, and bearing numerous anatropous ovules in two longitudinally oriented series between the dorsal and ventral veins, the ovules vascularized at least in part by branches of the dorsal vein. Chief trends of specialization: (1) reduction of the number of carpels, (2) closure of the megasporophyll with concomitant restriction of the stigmatic crests, (3) abaxial deformation of the megasporophylls with concomitant modification in the form and orientation of the stigmatic crests, locules, placentation, and vascularization, and (4) development of syncarpy in *Zygogynum*.

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GEOGRAPHICAL DISTRIBUTION OF THE WINTERACEAE

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IN THE preceding article in this Journal, Bailey and Nast (1) have summarized their conclusions concerning the comparative morphology of the Winteraceae and have commented upon the phylogenetic significance of the group. In view of the probable importance of this family in future considerations of primitive dicotyledons, a discussion of the implications of its geographical distribution seems to be desirable. The present paper is therefore complementary to the series of Bailey and Nast (see bibliography of the preceding article) and to the writer's taxonomic discussion of the family (28, 29, 30).

HISTORICAL SKETCH

The first known representative of the group of plants now known as the Winteraceae came to the attention of Europeans more than 350 years ago. In 1578 William Winter, who captained one of the ships on Drake's voyage, was forced by adverse weather to spend some weeks in the Straits of Magellan, and during this period his men learned of the antiscorbutic properties of the bark of a common Magellanic tree. This bark was brought to the attention of medical men and apparently was first described, under the name of "Winteranus cortex," by Dalechamps (7) in 1586. Subsequently the bark and the tree were described by such early students as Clusius (6), Bauhin (2), Parkinson (25), Jonston (20), Sloan (27), and Feuillée (17). At that time the "Winter's bark" was often confused with the bark of the West Indian *Canella alba* Murr., which apparently has somewhat similar properties.

A proper botanical description was given and a post-Linnaean binomial was first proposed for the plant in 1776. In this year J. R. & G. Forster (18) proposed the genus *Drimys,* with two species, the Magellanic *D. Winteri* and the New Zealand *D. axillaris,* both based upon the collections which they made during Cook's second voyage. In the same year Solander (19) published a description of the Magellanic species under the name *Winterana aromatica,* based upon collections by Captain Wallis and by Banks and Solander. The Forsters' name has been generally accepted for the generic and specific concepts as applied to the South American plant, and the binomial *Drimys Winteri* has appeared in innumerable botanical publications, often being accredited with an extensive geographical distribution which it does not possess. Typification of the genus *Drimys* and the use of the Forsters' binomial have already been adequately discussed (29: 10–17; 30: 154).

[1] In a recent bibliography (30: 164), I cited the title of a paper, "La distribution géographique et l'histoire des Winteraceae," which did not reach its destination in Switzerland in 1942, due to stoppage of mails. Some of the material in the unpublished paper is incorporated in the present treatment.

Long after its discovery in the far south, the genus was found at scattered points in South America and as far north as southern Mexico, while in Australia and New Zealand plants were found which were correctly referred to the general alliance of *Drimys Winteri*. For a long period *Drimys* and its relatives were placed in the family Magnoliaceae, but a separate family, the Winteraceae, was proposed by Lindley in 1836 (22). This name was accepted by such students of the group as Miers (24) and Eichler (15), but van Tieghem (31) rejected the name Winteraceae (founded upon *Wintera* Murr., a synonym of *Drimys*) and proposed to call the family the "Drimytacées" (apparently used in the Latin form only by Diels [11], as Drimytaceae). The essential synonymy of the family has already been recorded (30: 120), while Bailey and Nast (1) have discussed its composition and have given cogent reasons for the exclusion of the genus *Illicium*.

The first careful examination of generic lines in the Winteraceae was made by van Tieghem (31), and we are indebted to Dandy (9) for a proper disposition of the New Zealand species. The 88 species of the family now recognized (29, 30) are distributed in six genera, as follows: *Drimys* J. R. & G. Forst., with 40 species (Mexico to Cape Horn, Australia and Tasmania, New Guinea, Amboina, Celebes, Borneo, and the Philippines); *Bubbia* v. Tiegh., with 30 species (New Guinea, Queensland, Lord Howe Island, and New Caledonia); *Belliolum* v. Tiegh., with 8 species (New Caledonia and Solomon Islands); *Pseudowintera* Dandy, with 2 species (New Zealand); *Exospermum* v. Tiegh., with 2 species (New Caledonia); and *Zygogynum* Baill., with 6 species (New Caledonia).

In view of the inadequate exploration of some parts of the range of the family, conclusions as to its distribution must be partially tentative. It is not to be anticipated, however, that the broad outlines of distribution within the family will be greatly modified by future exploration or taxonomic readjustment. In the sense that all taxonomic work is preliminary and subject to future revision, the present discussion is tentative. To delay a presentation of geographical data and to refrain from drawing certain inferences from them, because they will inevitably be modified by future studies, seems undesirable to the writer.

PROBABLE CENTER OF ORIGIN

When the dicotyledons first appear in abundance in the fossil records of the Cretaceous Period, they are fully differentiated into surviving families and often even into surviving genera. The evolution of the principal families of woody dicotyledons long antedates the Middle Cretaceous, and therefore the place of origin and the early migrations of specific families cannot be determined solely upon the basis of present ranges, nor even upon ranges indicated by records from the Tertiary and Upper Cretaceous. The solution of such problems is dependent largely upon essential evidence from much earlier geological horizons.

Nevertheless, it is possible to reach certain preliminary conclusions regarding centers of origin from the evidence supplied by surviving members of a group, especially in cases where the phylogeny can be reconstructed

with reasonable exactitude, as in the Winteraceae (Bailey and Nast, 1). That such conclusions are to be taken as established fact is not suggested; they merely provide us with a hypothesis subject to future checking when and if the fossil record becomes more complete. The possibility that a group of plants originated in an area far from its present range must be kept in mind; only the fossil record can indicate whether such an origin is likely for a given group. In the case of the Winteraceae the fossil record, as stated below, is so incomplete and undependable that it throws no light upon the center of origin or routes of migration of the family. Recourse to deductive reasoning, based upon a knowledge of modern members of the group, is necessary if one is to arrive at any conclusions, even tentative ones, regarding the past history of the family.

The chief center of diversification and morphological specialization of the Winteraceae appears to have been in Australasia. That this region was the probable center of origin of the family is indicated by the following facts: all of the six known genera occur there and only one in America; at least 84 species are known in the Old World as contrasted with only four in America; the total variability of the group is infinitely greater in the Old World than in the New; the New World species are comparatively highly evolved, as regards several characters (xylem, calyx, stamens, carpels), in comparison with various Old World groups; on the whole, the Old World species are more stable than those of America, where inter- and intraspecific variability are marked. Furthermore, many of the families of woody Ranales — possibly the majority of these families — among which the relationships of the Winteraceae are to be sought are predominantly Asiatic, some of them exclusively so.

On the strength of this evidence one seems to have ample reason to eliminate America as the probable place of origin of the family. In narrowing down the probabilities offered by the general Australasian region, however, one is upon less secure ground, and the conclusions drawn in the following paragraph are to be taken as highly speculative.

It seems probable that generic differentiation in the Winteraceae was taking place at a period when the Australian continent included or nearly included such regions as New Guinea, New Zealand, New Caledonia, and the Solomon Islands. The fact that four of the six known genera now occur in New Caledonia does not necessarily indicate this region as the center of origin of the family. Two of the genera which occur there, *Exospermum* and *Zygogynum,* exhibit trends of morphological specialization which indicate that they are derivative genera. *Belliolum,* known only from the eastern rim of the Australasian portion of the family, likewise appears comparatively specialized in most of its characters, although its stamens may conceivably be more primitive than those of *Bubbia. Pseudowintera* similarly appears to be comparatively highly evolved, with a type of inflorescence and wood ray which indicates long isolation from the *Bubbia*-like group which was probably its ancestor. The two remaining genera, *Bubbia* and *Drimys,* occur in considerable numbers in the high-

lands of New Guinea. Both genera likewise occur in Queensland. *Bubbia*, however, is lacking in southeastern Australia and also in the Malayan islands extending toward the Philippines. Since the morphological evidence points to *Drimys* Sect. *Tasmannia* and *Bubbia* as more primitive, on the whole, than the remaining groups of the family, it might be inferred that the region where both these genera occur and where their speciation is most active is the probable place of origin of the family. This evidence points toward the New Guinea-Queensland area; but in suggesting this as the probable place of origin of the family one is indulging in speculation which can be verified only by future researches, especially those pertaining to palaeobotany.

ROUTES OF MIGRATION

The geographical distribution of the Winteraceae shows an interesting pattern (see map, 30: 121), which is by no means unique. A similar bicentric-palaeoantarctic distribution is found in the families Eucryphiaceae, Goodeniaceae, Stylidiaceae, Corsiaceae, and Centrolepidaceae. Some of these have a more extensive range than the Winteraceae and others a more restricted range; however, they are fundamentally similar in having representatives in southern America and also in Australasia (sometimes extending into Malaysia and Polynesia).

The only genus of Winteraceae which occurs in both hemispheres is *Drimys*, but examples of this type of generic distribution among angiosperms will occur to students of the regions under consideration. In order to illustrate, one need mention only the following genera, some of which are more restricted than *Drimys* and others more extended: *Nothofagus* (Fagaceae), *Phrygilanthus* (Loranthaceae), *Lomatia* (Proteaceae), *Colobanthus* (Caryophyllaceae), *Laurelia* (Monimiaceae), *Aristotelia* (Elaeocarpaceae), *Eucryphia* (Eucryphiaceae), *Drapetes* (Thymelaeaceae), *Fuchsia* (Onagraceae), *Pseudopanax* (Araliaceae), *Azorella* (Umbelliferae), *Griselinia* (Cornaceae), *Pernettya* (Ericaceae), *Jovellana* (Scrophulariaceae), *Hebe* (Scrophulariaceae), *Selliera* (Goodeniaceae), *Luzuriaga* (Philesiaceae), *Leptocarpus* (Restionaceae), and *Gaimardia* (Centrolepidaceae).

Contrasting with the illustrations given above, one may mention numerous families which occur in both hemispheres but which apparently have the two parts of their populations connected by a northern, rather than a southern, link. A few of these families are the Magnoliaceae, Schisandraceae, Calycanthaceae, and Nyssaceae, while illustrations of palaeoarctic genera are well known to every student of North American plants (e. g., Fernald, 16). Incidentally, the fact that *Illicium* shows this pattern of distribution rather than the Antarctic pattern may be cited as still another reason to question its presence in the Winteraceae.

In order to account for the type of distribution illustrated by *Drimys* and by numerous other plants and animals, various hypotheses have been formulated and a voluminous botanical and zoological literature has accumulated. In the case of the Winteraceae, a majority of which are

montane plants, the seeds are of such a morphological type and so perishable as to rule out any possibility of dispersal by winds, birds, animals, or oceanic currents. Terrestrial continuity is essential for the migration of members of this family. Thus, three possibilities seem to merit serious consideration: (1) Matthew's thesis of northern origins and southward migrations, (2) Wegener's hypothesis of continental drift, and (3) Antarctic land connections.

Palaeobotanical advocates of Matthew's (23) hypothesis of the origin and migration of animals have argued that *Drimys* originated in the Holarctic and subsequently migrated into its present ranges in the Southern Hemisphere. Thus, Berry (3: 165) states regarding the Magnoliaceae: "No family is more obviously of northern origin, none is better represented in the forest floras of Upper Cretaceous times throughout the northern lands, or better exhibits the southward extension so characteristic of many other types as the pressure of plant populations behind them and the availability of suitable land routes to the southward permitted. Drimys, the most primitive in its anatomy, is today found farthest from its original home. Unfortunately, the geological history of this genus is practically unknown but the fact that the species are distinct in each region, i. e., in Australia, New Caledonia, New Zealand and America, indicates that they were very ancient immigrants into those regions before the present geography had come into existence." Later (4: 38), the same author remarks: "Comparison of the geologic record with the recent distribution shows that *Magnolia* and *Liriodendron* radiated from a northern center of dispersal, and it seems most logical to assume that the increasingly southern belts for *Schizandra-Illicium, Talauma,* and *Drimys* represent a further continuation of the same direction of dispersal as *Magnolia* and *Liriodendron.*"

The chief arguments in these quotations are evidently based upon the following premises: (1) *Drimys* is a structurally primitive genus of the Magnoliaceae, (2) it formerly had a Holarctic distribution, and (3) *Magnolia* and its close allies were derived from ancestors having a characteristically northern distribution. Each of these premises is unreliable.

In the first place, *Drimys* and its five allied genera belong in an independent family which at best is only very remotely related to the Magnoliaceae proper and which was not concerned in the evolution of *Magnolia, Liriodendron,* and related genera.

In the second place, there is no evidence to indicate that the Winteraceae ever were widely distributed in the Holarctic. Of the four recorded fossil species of "*Drimys,*" three are from the Southern Hemisphere (Patagonia, Seymour Island, and New South Wales) and one from West Central Oregon. The four species are based upon leaf impressions. The papillate lower epidermis of *D. patagonica* Berry (4) suggests that this plant was winteraceous and allied to the surviving *D. brasiliensis* Miers. The reference of the Australian *D. levifolia* Deane (10) to the genus is entirely provisional, the identification being based on "a fragment of a leaf of thin texture, resembling *Drimys,* . . ."; at any rate, the occurrence of the genus

in the Tertiary of New South Wales, if corroborated, throws no light upon its distribution outside the modern range. Unfortunately, in the case of the geographically most significant fossil species, *D. antarctica* Dusén (13) and *D. americana* Chaney and Sanborn (5), no critical evidence is presented regarding their actual affinities. Until the stomata and cuticles or the vascular residues of such fossils are examined by modern palaeobotanical techniques, determinations of Winteraceae based solely upon superficial characters of leaf impressions must be considered unreliable. In other words, there is no conclusive evidence that *Drimys* ever occurred north of its present extensions into Mexico and the Philippines, nor conversely that it was formerly widely distributed in Antarctica. Furthermore, the occurrence of *Drimys* in the Goshen flora of Oregon, if authenticated, does not indicate that the Winteraceae are of northern rather than of southern origin, since it may be interpreted merely as extending the northern limits of the genus (during an admittedly warmer period) from Mexico to Oregon. The absence of Winteraceae in the numerous investigated Cretaceous and Tertiary floras of the Northern Hemisphere is to be anticipated, however, if the family is of extra-Holarctic origin and distribution with only subsidiary extensions north of the equator.

In the third place, although *Magnolia* and *Liriodendron* were abundantly represented in Upper Cretaceous and Tertiary floras of northern latitudes, there is no available evidence to indicate that the Magnoliaceae (sensu stricto) originated in the Holarctic or that such genera as *Talauma, Manglietia, Aromadendron, Elmerrillia,* etc., migrated southward into their present ranges in tropical and subtropical regions. The Magnoliaceae are morphologically relatively highly specialized both vegetatively and florally, and furthermore are a family with quite different morphological limits and generic diversity than supposed by Berry (3: 165) (e. g. Dandy, 8). They evidently are related to, but not directly derived from, the Degeneriaceae (Fiji) and Himantandraceae (Queensland and New Guinea). Nothing is known at present regarding the distribution of ancestral forms from which the three related families were derived.

Although the Wegener hypothesis of continental drift appears to be inacceptible at present to most geophysicists and geologists, at least in America, it continues to have an intriguing appeal to biologists. The ultimate acceptance or rejection of this hypothesis must rest upon geological grounds, but so many biological data have been cited to support it that it seems advisable to inquire into its application to problems of Antarctic distribution, and especially to the specific problem at hand. According to this hypothesis and its subsequent modifications, Pangaea was a single continent, eventually with two lines of rupture in the Mezozoic — between Euro-Africa and America, and between Africa and India. During the Jurassic, Australia broke away from India and Ceylon, and Antarctica from Africa, both retaining their connection with South America. Australia and Antarctica separated in the Tertiary, but Antarctica and South America did not separate until the Quaternary.

According to Du Toit's (14) modification of the Wegener hypothesis, there were two original continents, Gondwanaland and Laurasia, separated by the Tethys Sea. At the beginning of the Cretaceous, Australia was still connected, by way of Madagascar and India, with southern Asia. New Guinea and New Zealand broke away from Australia in the Tertiary; Antarctica separated from South America recently.

As far as the Antarctic distribution of plants is concerned, these two explanations have about the same bearing. Australia is supposed to have lost its connection with the Asiatic continent no later than the early Cretaceous, retaining its connection with America, via Antarctica, until the Tertiary. As a broad explanation of Antarctic distributions, this hypothesis is often quite credible. However, one is led to believe that the Australian flora should be more intimately related to that of America than to that of southeastern Asia. This should also be true of the New Guinean flora, which, according to all modifications of the Wegener hypothesis, should be more closely related to that of Australia than to that of Malaysia.

This, however, is not the case; the New Guinean flora is overwhelmingly Malaysian in its affinities, with fewer Australian elements. It would seem impossible to avoid the conclusion that Australia and southeastern Asia have been linked, via New Guinea and Malaysia, at some time since the differentiation of angiosperm genera. The connection between the floras of Australia and America is less pronounced, on the whole, than that between the floras of Australia and Malaysia.

Although the predominantly Asiatic elements in the New Guinean flora were acknowledged by such an authority on the region as Lam (21), the theory of the permanence of continents in this region was rejected by him in favor of Wegener's hypothesis. According to Lam, the Australian shelf, becoming disjoined from Antarctica and drifting northward, came into contact with the southeastern parts of Asia (the Malaysian arches) and was overrun with tropical species. This ingenious explanation might satisfy the facts if only the widespread lowland groups of plants were concerned. But the numerous groups of plants in common between the mountains of New Guinea and of Malaysia (*Drimys,* as an illustration, occurring in Borneo and the Philippines) cannot be explained as "recent adventives" which have passed from one region to the other in comparatively recent times, since the two areas have again drifted into proximity. On the contrary, many of them (including *Drimys*) are obviously relics, with limited means of dispersal and a high degree of local endemism.

In brief, the Wegener hypothesis, if it could be substantiated geologically, provides the terrestrial continuities necessary for the migration of *Drimys* from Australasia to South America via Antarctica, but it does not afford a valid explanation for the present distribution of *Drimys* and other montane plants of limited migrational ability in the Australasian-Malaysian regions.

The remaining hypothesis pertaining to bicentric-palaeoantarctic distributions assumes that the major land masses of the Southern Hemisphere

have been in essentially their present positions for a long period, at least since the differentiation of modern families of flowering plants; to explain the existence of the same genus, or of closely related genera, in the austral parts of both hemispheres, one assumes past land connections through Antarctica. The present environment of Antarctica is obviously unfavorable to the survival of angiosperms and gymnosperms, but the continent does have a known flora of about 75 mosses, six hepatics, and no fewer than 250 lichens (Skottsberg, 26). That at least parts of Antarctica supported a well-developed flora of angiosperms and conifers during the Tertiary and Cretaceous Periods, as well as a diversified fauna, is demonstrated, however, by fossils obtained by the Swedish South Polar Expedition. One need not assume an Antarctic origin for these plants, but merely that they reached Antarctica from one hemisphere or the other by a more or less continuous land route.

The existence of this flora being reasonably certain, it remains to connect Antarctica with America on the one hand and Australasia on the other. Most proponents of the "land-bridge" hypothesis do not imply that continuous unbroken connections were essential for the migrations of plants and land animals. On the contrary, fluctuating and comparatively ephemeral connections, often insular in nature, would provide adequate "bridges" for most migrations. Furthermore, these connections, as far as the woody dicotyledons are concerned, could well be pre-Cretaceous. The ultimate acceptance or rejection of any "land-bridge" hypothesis in a given region and period must rest upon geological evidence, but even when the present geological evidence is negative in nature, the possibility of past land connections is not to be absolutely ruled out. Biological distributional data can provide only suggestions for the solution of this essentially geological problem.

In the case of austral connections, however, the American-Antarctic land connection by means of the Scoatia Arc seems to be beyond doubt, as indicated by geological observations in the South Orkneys and South Georgia, which agree with the folded ranges of the American continent; that this connection between the two continents was Cretaceous or early Tertiary has been substantiated by the discovery of fossil foraminifera. The mountains of Antarctica in many ways suggest the Andes of South America. (For a brief review of the geological evidence of this connection, the reader is referred to Du Rietz [12], where an extensive bibliography will be found.)

There was no such definite land connection between Antarctica and Australasia, but merely because geologists cannot point with certainty to this connection one is not justified in rejecting its probability. On the basis of plant distribution we may best hypothecate two independent and not necessarily simultaneous or complete connections between Antarctica and Australasia, one with New Zealand and one with Tasmania. The distribution of *Drimys,* for instance, points to the Tasmanian connection, for the New Zealand genus of Winteraceae, *Pseudowintera,* has no close rela-

tive in America. However, possibly the greater number of bicentric-palaeo-antarctic groups show the New Zealand rather than the Tasmanian affinity. Berry (4: 32–40) lays considerable stress upon the fact that many groups of plants cited in support of the theory of trans-Antarctic migration occur either in Australia or New Zealand, but not in both regions. This fact loses much of its significance if the two regions can be assumed to have had independent connections with Antarctica—an assumption, to be sure, which still awaits geological proof.

It is outside the scope of the present paper to discuss the numerous groups which have been cited as illustrations of trans-Antarctic migrations. Each of these groups needs detailed taxonomic and morphological investigation before even tentative conclusions as to its migratory routes can be reached. It is obvious that much of the discussion pertaining to this problem has been based upon inadequate data. Furthermore, there is no single solution to the problem, and conclusions which appear valid in one group may be entirely inapplicable to the next, even though their present distributions are superficially similar. It is also obvious that geological evidence must supply the ultimate answer to the problem. Nevertheless, the vast amount of accumulating biological evidence that distribution in certain groups took place by trans-Antarctic migrations is rapidly becoming incontrovertible.

SPECIATION

A consideration of the possible modes of speciation within a group is often a desirable complement to a discussion of geographical distribution, since migrations and speciation are frequently concomitant phenomena. It is obvious that in the Winteraceae, as pointed out by Bailey and Nast (1), there is no surviving genus which is "primitive" in all of its characters; on the contrary each genus is characterized by a combination of characters — some primitive and others advanced — in such a way as to indicate that the ancestral form possessed characters no longer found in combination.

The genus *Drimys,* since it occurs in both hemispheres, is of especial interest as illustrating intra-generic differentiation in the family. The American and the Old World representatives fall into two sharply marked sections, which could logically be re-established as independent genera, *Drimys* in America and *Tasmannia* in the Old World. Whether one thus recognizes two genera or two sections of a single genus, as we have done, seems immaterial to the present discussion. It is impossible to say that either of these sections is more primitive than the other. The Section *Tasmannia* appears closer to the hypothetical primitive condition in characters pertaining to its xylem, pollen, and carpels, while the Section *Wintera* seems to be the more primitive in its inflorescence and its hermaphrodite flowers.

It is significant that, of the six Australasian genera, only one, *Drimys,* occurs in America. In a preceding section I have mentioned the extreme improbability of the family having originated in America. If the origin of the family was in Australasian regions, as seems likely, one should perhaps

attempt to explain (1) why none of the genera except *Drimys* reached America, and (2) why the American representatives of *Drimys* are more primitive in some features than their Australasian congeners.

Whether the absence of all genera of the family except *Drimys* from America is due merely to chance dissemination of genetic factors in the migrating population or whether selective factors of the environment along the route of migration were operational must remain doubtful. At least the possibility of the operation of selective factors is suggested by the fact that *Drimys*, in its present range in New Guinea and Australia, survives a colder and less hospitable climate than any of the other existing genera. If the migrational route to America was through Antarctica, as hypothecated above, that portion of the family most resistant to the climate of high altitudes and high latitudes would have been most likely to make the successful migration; it cannot be assumed that the climate of Antarctica was ever tropical — more likely it was subtropical or temperate at best.

The fact that the Section *Wintera* combines certain primitive with other comparatively advanced characters is not necessarily a contradiction of an assumption that this is the migrating portion of the genus. It is merely necessary to assume that the separation of the genus into an eastern and a western population took place before such characters were fully stablized. Again, it is impossible to suggest whether the segregation of genetic factors was due entirely to chance or whether certain unsuspected selective factors were involved.

A distribution map of the species and varieties of the Section *Wintera* (29: 9) shows the scattered occurrence of isolated units which is often characteristic of ancient groups. Predominantly montane in habit, *Drimys* approaches sea-level only in the southernmost part of America, whereas toward the north it often occurs near the upper limit of arboreal vegetation. It is significant that the genus occurs in the two oldest mountain masses of South America — the Organ Mountains and the Pacaraima Range — as well as in the Andes. The genus was apparently widespread in South America at a period when the two older mountain ranges had some sort of a highland connection with the Andean region.

The criteria used for specific and varietal delimitation have been discussed in my taxonomic consideration of Sect. *Wintera* (29), where the unsatisfactory nature of some of these criteria was emphasized. The entire American population of *Drimys* is still highly polymorphic, and classification within the genus in this region must be based upon trends rather than upon concrete morphological characters. In the absence of any discernible morphological barriers, it may be suspected that all the members of Sect. *Wintera* will prove to be interfertile. However, this is not the case in nature, the disjunction of the various populations being maintained by poor dispersal capacity and presumably also by the intervention of inhospitable regions. Apparently a fairly high rate of precipitation is essential for the survival of the genus, and a glance at the above-mentioned map (29: 9) will indicate that extensive regions of comparatively dry country separate some of the areas of persistence.

The present-day groups in Sect. *Wintera* were presumably polytopic in origin. The existence of a linking ancestral syngameon cannot definitely be proved, in the absence of fossil evidence, but it may be hypothecated with considerable assurance, in view of the limited dispersal ability of the genus. The causes of the disappearance of the ancestral syngameon may possibly lie in climatic changes pertaining to a narrowing or a shifting of high precipitation areas; this, however, is speculative.

It may be assumed that in the original large polymorphic population the genetic constitution of the various parts was not identical. As a result of geographical isolation of the component parts, the potential variability of these parts was necessarily reduced, and therefore the surviving groups are not genetically identical. There is no obvious indication of the operation of selective factors in the present-day environments of the various local units, and hence it seems likely that chance dissemination of genetic material throughout the original population was primarily responsible for the different morphological trends.

The possibility, at least, that polyploidy is involved in the evolution of taxonomic units in Sect. *Wintera* is indicated by Whitaker's (32) record of the chromosomes of *"Drimys Winteri"* as about 76 in number. This record, however, is insufficient to be taken as a basis for discussion.

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NEW KWANGSI PLANTS[1]

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IN THIS paper, twelve new species and one new variety are described, all based on types from Kwangsi Province, China. In addition, three new combinations are made. Three of the new species were named by Dr. E. D. Merrill, in preliminary studies on the Chinese collections in the herbarium of the Arnold Arboretum. This paper is essentially a continuation of a previous article in this Journal (Jour. Arnold Arb. 24: 444–459. 1943). All specimens herein cited are deposited in the herbarium of the Arnold Arboretum.

OLACACEAE

Olax laxiflora Merrill in herb. sp. nov.

Frutex scandens, 0.5–3.5 m. altus, ramis ramulisque brunneis glabris, lenticellis linearibus vel nullis; foliis chartaceis vel subcoriaceis, breviter petiolatis, oblongo-ovatis, 12–15 cm. longis, 5–6.5 cm. latis, acuminatis, basi late rotundatis, utrinque glabris subconcoloribus, supra nitidis, subtus paullo pallidioribus, nervis lateralibus utrinsecus 12–15, latissime patentibus, utrinque distinctis, sat procul a margine arcuato-anastomosantibus, rete venularum utrinque elevato; petiolis circiter 1 cm. longis; inflorescentiis axillaribus glabris paniculatis, 3.5–4.5 cm. longis, laxifloris, bracteis brevibus, distantibus, pedicellis 3–4 mm. longis; calycibus 1.5 mm. longis, plus minusve cuspidato-truncatis, glabris, margine submembranaceis integris; petalis 5, linearibus, circiter 10 mm. longis et 1 mm. latis; staminibus 5, filamentis complanatis, gracilibus, circiter 5 mm. longis et 0.8 mm. latis, antheris ellipticis, circiter 1.8 mm. longis; ovario ovoideo, stylo ad 8 mm. longo, stigmate obscure 3-lobato, lobis ovoideis; fructibus oblongo-obovoideis, circiter 2.8 cm. longis et 1.3 cm. latis, calyce accrescente totis circumdatis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22231* (TYPE), May 7, 1933, 0.5–3 m. high, fairly common in dry sandy places, flowers pale yellow; same locality, Na Wai Village, *W. T. Tsang 23863*, July 11–30, 1934, a climber 10.5 ft. high, fairly common in sandy soil, in thickets, fruit red, edible.

The new species is characterized by its large leaves, which are broadly rounded at base, its lax inflorescences, and its much elongated, slightly ovoid fruits.

ANNONACEAE

Fissistigma capitatum Merrill in herb. sp. nov.

Frutex scandens, ramulis teretibus brunneo-tomentosis; foliis subcoriaceis petiolatis, oblongo-ovatis, 9–15 cm. longis, 4.5–8 cm. latis, late rotundatis, leviter emarginatis, basi rotundatis, margine leviter revolutis, supra in sicco olivaceis, leviter tomentosis vel glabrescentibus, subnitidis,

[1] Prepared with partial support of a grant from the Penrose Fund, American Philosophical Society, to Dr. E. D. Merrill, to assist him in working up the accumulated collections of Chinese botanical material in the herbarium of the Arnold Arboretum.

subtus in sicco brunneis, minute tomentosis, nervis lateralibus utrinsecus 15–18, supra distinctis, subtus elevatis, adscendentibus, venis tertiariis gracilibus, plus minusve parallelis, supra subconspicuis, subtus distinctis; petiolo 1–1.3 cm. longo, crasso, supra canaliculato, tomentoso; inflorescentiis oppositifoliis capitatis multifloris circiter 2 cm. diametro, pedunculis circiter 5 mm. longis, tomentosis, bracteis lanceolatis, acuminatis, circiter 7 mm. longis et 2 mm. latis, utrinque tomentellis; floribus subsessilibus (immaturis), calycibus 3-lobatis, lobis lanceolatis acuminatis, 6–7 mm. longis, tomentellis, basi cordatis; petalis 6.5 mm. longis, 3 exterioribus extus tomentellis; staminibus numerosis; carpellis dense tomentosis.

KWANGSI: Bako Shan, *R. C. Ching 7674,* Sept. 26, 1928; Chen-pien District, *S. P. Ko 56075* (TYPE), Nov. 19, 1935, a woody vine, in forests.

Although both specimens bear young flowers only, we do not hesitate to describe this as a new species on account of its very distinctly capitate more or less sessile flowers with long acuminate calyx-lobes.

SAXIFRAGACEAE

Cardiandra laxiflora sp. nov.

Subherbacea circiter 0.5 m. alta, caulibus brunneis sulcatis sparse pilosis 6 mm. diametro; foliis alternis petiolatis oblongo-ellipticis, 15–20 cm. longis, 7–9 cm. latis, acuminatis, basi longe attenuatis, margine grosse serratis, supra atro-viridibus sparse pilosis, subtus pallidioribus, costa nervisque supra glabris, subtus sparse pilosis, utrinque distinctis, nervis lateralibus utrinsecus 10–12 adscendentibus prope marginem arcuato-anastomosantibus, venulis utrinque subconspicuis; petiolo 2–4 cm. longo; inflorescentiis terminalibus longe pedunculatis laxe paniculato-corymbosis, circiter 13 cm. longis et 6 cm. latis, puberulis, pedunculis circiter 8 cm. longis, ramis circiter 1.5 cm. longis, basi bracteatis, bracteis linearibus; floribus paucis parvis exterioribus in corymbo sterilibus, longe pedicellatis, pedicellis circiter 1–1.5 cm. longis, calycis segmentis binis aequalibus, petaloideis albidis obovatis, 0.8–1.3 cm. longis, 0.6–1.2 cm. latis, venosis; floribus interioribus in corymbo fertilibus, pedicellis 3–6 mm. longis, calycis tubo ovario adnato hemisphaerico leviter puberulo vel glabro, 0.75–1 mm. longo, lobis 4 vel 5 triangulari-ovatis circiter 0.75 mm. longis; petalis 5 raro 4 albis imbricatis ovatis rotundatis circiter 2.5 mm. longis et 2 mm. latis; staminibus circiter 15 epigynis, filamentis filiformibus, 3 mm. longis, antheris obcordato-truncatis 0.5 mm. longis; ovario 3-loculari, stylis 3 liberis brevibus 0.5 mm. longis, subconicis, stigmate capitato.

KWANGSI: Tzu-yuen District, *Z. S. Chung 83587* (TYPE), Aug. 7, 1937, an herb in woods near stream, flowers white.

This is the second species of the genus to be found in China. The other species, **Cardiandra Moellendorffii** (Hance) comb. nov. (*Hydrangea Moellendorffii* Hance, Jour. Bot. 12: 177. 1874; *Cardiandra sinensis* Hemsley, Gard. Chron. III. 23: 82. 1903; *Cardiandra alternifolia* Sieb. & Zucc. var. *Moellendorffii* Engl. [as *Moellendorfii*] in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 18a: 201. 1928) is found in Hupeh, northern Kiangsi, and northern Chekiang. It differs from this new species mainly in the thicker, smaller leaves, larger and denser inflorescences, and the thicker, smaller bracts.

A photograph and fragments of the type of *Hydrangea Moellendorffii* Hance (*O. F. Moellendorff s. n.*, from Kiukiang, Kiangsi) are in the herbarium of the Arnold Arboretum. It is manifestly the same as *Cardiandra sinensis* Hemsley, as pointed out by Engler (l.c.). However, it differs from typical *Cardiandra alternifolia* Sieb. & Zucc. of Japan as much as do any other proposed species of the genus from Formosa and elsewhere, and to treat it as a variety of the Japanese species is not deemed advisable unless the genus is considered as monotypic and all species reduced to varieties of a single one, a treatment which is scarcely warranted in view of the wide geographical distribution of the group.

ROSACEAE

Photinia kwangsiensis sp. nov.

Arbor circiter 15 m. alta, ramulis hornotinis dense et adpresse brunneo-villosulis, annotinis villosulis vel subglabris; foliis persistentibus subcoriaceis, oblongo-ovatis vel oblongo-lanceolatis, 8–12 cm. longis, 3–4 cm. latis, acuminatis, basi late acutis vel subrotundatis, margine leviter revolutis, minute et conferte glanduloso-serrulatis, in sicco olivaceo-brunneis, utrinque subconcoloribus, supra haud nitidis glabris costa villosula exceptis, subtus dense villosulis, costa supra leviter impressa, subtus valde elevata, conspicua, venis lateralibus utrinsecus 12–15, valde obliquis, gracilibus, prope marginem anastomosantibus, supra inconspicuis, subtus distinctis, venulis subtiliter et dense reticulatis, supra elevatis; petiolo 1.5–2 cm. longo, dense villosulo; floribus ignotis; infructescentiis corymbosis terminalibus multifructigeris, 8–9 cm. longis, 12–13 cm. diametro, axibus secondariis teretibus villosulis, infimis saepe subverticillatis, pedicellis 3–5 mm. longis, villosulis, bracteis bracteolisque caducis; fructibus subglobosis, aurantiaco-rubris, 5 mm. longis, villosulis vel subglabris, calycis dentibus persistentibus incurvis.

KWANGSI: Liow Shaing, Tseung-yuen, *C. Wang 39616,* June 30, 1936; Yao Shan, *C. Wang 40293* (TYPE), Oct. 22, 1936, a tree 15 m. high, on river banks, fruits green.

In its pubescent leaves and other characters this species is near *Photinia Griffithii* Decaisne, differing in the more spreading nerves, the upper surfaces not shining but with distinct fine reticulations, and the more numerous minute glandular teeth along the margins.

Rubus septemlobus sp. nov. Subgenus *Idaeobatus,* § *Corchorifolii.*

Frutex scandens, ramulis dense brunneo-pubescentibus sparse aculeatis, aculeis 1 mm. longis, rectis; foliis simplicibus coriaceis petiolatis, palmatim ad ¼ 7-lobis, circiter 15 cm. diametro, in sicco supra atro-olivaceis, glabrescentibus venis pubescentibus exceptis, subtus dense brunneo-pubescentibus, lobis ovato-oblongis vel ovato-lanceolatis, terminalibus majoribus 8–9 cm. longis, 3–3.5 cm. latis, inferioribus minoribus 3–4 cm. longis, 1.5–2 cm. latis, ceteris intermediis, apice acuminatis, margine irregulariter serrulatis, venis venulisque supra leviter impressis, subtus elevatis; petiolis 5–6 cm. longis, dense brunneo-pubescentibus, sparse aculeatis, aculeis recurvis; stipulis foliaceis ovatis 1–1.2 cm. longis, 0.5–7.5 cm. latis, fimbriato-dissectis, extus pubescentibus, intus glabris; floribus (immaturis) axillaribus, 1 vel 2, subsessilibus, bracteis numerosis, foliaceis ovatis, 1–1.5 cm. longis, 0.5–1 cm. latis, margine fimbriatis vel subintegris, extus dense pubescentibus, intus glabris; calycis tubo 4 mm. longo, dense pubescente,

lobis triangulari-ovatis, 2–3 mm. longis, 2–2.5 mm. latis; petalis albidis; staminibus numerosis.

KWANGSI: Yao Shan, Ping Nam, *C. Wang 39117* (TYPE), May 8, 1936, a scandent shrub, in ravines, flowers white.

A distinct species characterized by the deeply 7-lobed leaves. It is probably closest to *Rubus acuarius* Focke, of Yunnan.

Rubus kwangsiensis sp. nov. Subgenus *Idaeobatus*, § *Corchorifolii*.

Frutex scandens, ramulis glabris sparse aculeatis, aculeis 4–5 mm. longis, recurvis; foliis simplicibus membranaceis, longe petiolatis, oblongo-ovatis, 10–12 cm. longis, 5–7 cm. latis, longe acuminatis, basi subcordatis, margine irregulariter serrulatis, supra glabris nervis leviter pubescentibus exceptis, subtus glabris, nervis lateralibus utrinsecus circiter 8, arcuato-adscendentibus, venulis inconspicuis; petiolo 2.5–3.5 cm. longo, glabro, raro 1- vel 2-aculeato; stipulis lanceolatis adnatis, 6–8 mm. longis; floribus solitariis axillaribus, circiter 2 cm. diametro, pedicellis circiter 1 cm. longis, glabris; calycis tubo extus glabro, lobis longe ovato-triangularibus, 8 mm. longis, 3 mm. latis, longe acuminatis, intus dense puberulis; petalis rubris obovatis, circiter 8 mm. longis et 7 mm. latis; staminibus numerosis; carpellis numerosis; fructu ignoto.

KWANGSI: Tzu-yuen District, *Z. S. Chung 81673* (TYPE), May 21, 1936, a scandent shrub in forests, flowers red.

A species related to *Rubus corchorifolius* Linn. f., differing in the large membranaceous leaves, which are glabrous and not soft-pubescent beneath, and in the red flowers with relatively short petals.

Rosa kwangsiensis sp. nov. § *Synstylae*.

Frutex scandens, ramis ramulisque cinereo-brunneis, aculeis sparsis 4–6 mm. longis, basi valde dilatatis; foliis 3–7-foliolatis, petiolis inclusis 8–11 cm. longis, petiolis rhachibusque sparse aculeatis; foliolis membranaceis sessilibus vel subsessilibus ovatis vel obovatis, 3–6 cm. longis, 2–3 cm. latis, acutis, basi late acutis vel subrotundatis, simpliciter serratis, utrinque glabris, supra atro-viridibus, subtus pallide viridibus, nervis lateralibus utrinsecus 6–8, supra subconspicuis, subtus elevatis, rete venularum obscuro; petiolis 2–2.5 cm. longis, sparse tomentosis; stipulis adnatis, circiter 2 cm. longis, acuminatis, auriculis divergentibus 5–8 mm. longis triangularibus vel lanceolatis, margine distincte fimbriatis, stipitato-glandulosis; floribus rubris, 3–3.5 cm. diametro, in corymbis terminalibus multifloris 10 cm. longis latisque dispositis; bracteis foliaceis, oblongo-lanceolatis acuminatis, ad 8 mm. longis et 2 cm. latis, margine distincte fimbriatis; pedicellis gracilibus 1–1.5 cm. longis, glabris; receptaculis depresso-ovoideis, glabris, 4–5 mm. longis; sepalis ovato-lanceolatis, circiter 8 mm. longis et 3 mm. latis, apice longe acuminatis, extus glabris, margine et intus dense pubescentibus; petalis late obovatis, circiter 1.2 cm. longis et 8 mm. latis, emarginatis; filamentis ad 6 mm. longis; stylo unico glabro 5 mm. longo, stigmate capitato.

KWANGSI: Shuen-yuen, *Z. S. Chung 81540* (TYPE), May 12, 1936, a scandent shrub, flowers reddish.

A species allied to *Rosa Brunoniana* Lindl., differing notably in the glabrous pedicels and receptacles, the laciniate bracts and stipules, and the glabrous styles.

Rosa paucispinosa sp. nov. § *Synstylae.*

Frutex scandens, ramis atro-brunneis, aculeis paucis, 2–3 mm. longis, ramulis brunneis glabris inermis; foliis 5-foliolatis, petiolis inclusis 15–19 cm. longis, petiolis rhachibusque inermis, glabris; foliolis sessilibus chartaceis ovatis, 8–11 cm. longis, 3.5–5 cm. latis, longe acuminatis, basi acutis vel subrotundatis, margine simpliciter serratis, utrinque glabris, in sicco supra olivaceis, subtus pallidioribus, nervis lateralibus utrinsecus 8–10, supra subdistinctis, subtus elevatis, rete venularum supra inconspicuo subtus subconspicuo; petiolo 4.5–5 cm. longo; stipulis lanceolatis adnatis, 2–2.8 cm. longis, apice divergentibus, lanceolatis, acuminatis; floribus ignotis; infructescentiis terminalibus subumbellatis puberulis circiter 5-fructigeris; pedunculis circiter 1.7 cm. longis, pedicellis 2.5–3 cm. longis; fructibus globosis vel subglobosis, 1.5–2 cm. diametro, rubris, sparse puberulis vel glabrescentibus; stylo unico, 7 mm. longo; sepalis persistentibus vel deciduis, triangulari-ovatis, 6–7 mm. longis, 4–5 mm. latis, acutis, utrinque pubescentibus.

KWANGSI: Yao Shan, *C. Wang 40547* (TYPE), Dec. 4, 1936, climbing on trees, fruit red.

Although the flowers are unknown, this species appears to be strongly characterized by its very few prickles, large glabrous leaves, and large fruits, which are subumbellately arranged on a terminal peduncle.

Pygeum laxiflorum Merrill in herb. sp. nov. § *Cylopygeum.*

Arbor 7–12 m. alta inflorescentiis exceptis glabra, ramis teretibus purpureo-brunneis, consperse lenticellatis, ramulis circiter 1 mm. diametro, glabris; foliis chartaceis, ovato-lanceolatis, 8–10 cm. longis, 3–3.5 cm. latis, graciliter caudato-acuminatis, basi late acutis, margine integris, supra glabris olivaceo-brunneis, subtus pallidioribus glabris, glandulis nullis vel planis, nervis lateralibus utrinsecus 6–8, gracilibus, curvato-adscendentibus, prope marginem arcuato-anastomosantibus, supra leviter impressis, subtus elevatis, rete venularum utrinque leviter impresso, subconspicuo; petiolo 6–8 mm. longo, glabro; inflorescentiis spicatis axillaribus solitariis vel 2- vel 3-fasciculatis, gracilibus, primo minute pubescentibus, demum glabrescentibus, bracteolis minutis deciduis; floribus laxis, pedicellis gracilibus circiter 3 mm. longis; calycis tubo infundibuliformi, 1.5 mm. longo, 2 mm. diametro, extus minute puberulo, segmentis 10, 5 (sepalis) triangulari-ovatis, acuminatis, 0.5 mm. longis, puberulis, 5 (petalis) oblongis, obtusis vel rotundatis, 1 mm. longis, dense pubescentibus; staminibus circiter 15, filamentis glabris, usque 4 mm. longis; ovario glabro, stylo 3 mm. longo, glabro; fructibus oblongis, transverse dilatatis, circiter 7 mm. longis et 9 mm. latis, atro-purpureis, glabris, lignosis, semine solitario.

KWANGTUNG: Shih Wan Tai Shan, *H. Y. Liang 69816,* July 21, 1937, a tree 9 m. high, in light woods, flowers white. KWANGSI: Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24375* (TYPE), Sept. 28, 1934, a tree 20 ft. high, flowers white, fragrant. INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26891,* Sept. 27–30, 1936, a small tree 20 ft. high, fairly common in thickets, in dry clayey soil, fruits black; Ha-coi, Chuk-phai, Taai Wong Mo Shan and vicinity, *W. T. Tsang 27088,* Oct. 23–31, 1936, *27221,* Nov. 10–17, 1936, a tree, 20–35 ft. high, fairly common in thickets, fruits black.

THEACEAE

Tutcheria hirta (Hand.-Maz.) comb. nov.

Gordonia ? hirta Hand.-Maz. Anz. Akad. Wiss. Wien 58: 180. 1921.

Tutcheria villosa Wu, Bot. Jahrb. 71: 192, 1940, syn. nov.

HUPEH: Enshih District, *H. C. Chow 1812*, Oct. 29, 1934. KWEICHOW: Between Kuchow and Liping, *H. Handel-Mazzetti 10930* (ISOTYPE). KWANGSI: San-chiang District, *Steward & Cheo 1045*, Sept. 12, 1933; Pai-shou District, Pai-shou Shan, *Y. W. Taam 61*, Aug. 23, 1935; Shing-an District, *Z. S. Chung 81812*, June 19, 1936; Shan Chuen, *Z. S. Chung 83383*, July 2, 1937.

Handel-Mazzetti was uncertain as to the genus of this species, as he had no fruiting material. Wu was correct in his generic determination but he also had no fruiting material. Fruits are found in the *Steward & Cheo*, *Taam*, and *Chow* numbers cited above. The fruits are ovoid, 3-ridged, about 1.5 cm. long and 0.7 cm. across, pointed, and pubescent. This is the only known species of the genus that has its leaves pubescent beneath.

Tutcheria hirta var. **grandiflora** (Wu) comb. nov.

Tutcheria villosa var. *grandiflora* Wu, Bot. Jahrb. 71: 193. 1940.

KWANGSI.

Tutcheria hirta var. **cordatula** var. nov.

A typo speciei differt foliis basi cordatulis.

KWANGSI: Shih Wan Tai Shan, Tai Mien Shan, *H. Y. Liang 69639* (TYPE), July 14, 1937, a tree 7–12 m. high, in mixed dense forests along streams.

Hartia cordifolia sp. nov.

Arbor 12–18 m. alta, ramis glabris, ramulis novellis teretibus, leviter villosis; foliis glabris chartaceis ovatis, 5–8 cm. longis, 3–4.5 cm. latis, acutis vel acuminatis, basi cordatis, margine remote serrulatis, in sicco olivaceis, utrinque subconcoloribus, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 6–8 cum venulis supra leviter impressis, subtus subelevatis; petiolis valde alatis, 1.5–2.5 cm. longis, 3–4 mm. latis, leviter villosis vel subglabris; floribus axillaribus solitariis, pedicellis 2–5 mm. longis, sericeo-pilosis, pilis albidis; sepalis ovatis, 10 mm. longis, 8 mm. latis, obtusis vel rotundatis, extus leviter pubescentibus, intus glabris; petalis oblongo-obovatis, 1.2–1.4 cm. longis, 8–10 mm. latis, extus dense pallide sericeo-pubescentibus, intus glabris; staminibus numerosis, 6–8 mm. longis, filamentis alte connatis; ovario conico, dense pubescente; fructibus capsularibus ligneis, apice acutis, ad 1 cm. longis, 1.4 cm. diametro, valvis 5 crassis, sepalis persistentibus, pedicellis 2–5 mm. longis.

KWANGSI: Yao Shan, Tseung-yuen, *C. Wang 39433* (TYPE), June 19, 1936, a tree 12 m. high, in woods; Yao Shan, *C. Wang 40104*, Oct. 14, 1936, a tree 18 m. tall, in mixed woods, fruits green.

This species is near *Hartia micrantha* Chun, but it may be distinguished by the broader, shorter, and distinctly cordate leaves. The petioles are broadly winged.

Adinandra bracteata sp. nov.

Arbor 12 m. alta, omnino glabra, ramulis teretibus purpureo-brunneis striatis haud lenticellatis; foliis subcoriaceis ellipticis, 8–10 cm. longis, 3.5–6 cm. latis, obtusis vel acutis, basi acutis, margine integris vel parce minute serrulatis, supra atro-viridibus, subtus pallidioribus, in sicco utrinque brunneo-olivaceis, costa supra impressa, subtus elevata, nervis lateralibus 6–10, utrinque subconspicuis, venis tertiariis inconspicuis; petiolo 1–1.5 cm. longo, utrinque canaliculato; floribus solitariis axillaribus, basi 2-bracteatis, bracteis coriaceis ovatis, 6 mm. longis, 4–5 mm. latis, obtusis,

pedicellis 2–3 mm. longis; sepalis coriaceis, suborbicularibus, rotundatis, 12 mm. longis, 10 mm. latis, margine integris, interdum parce ciliatis; petalis (immaturis) ovatis, 1.5 cm. longis, 1.2 cm. latis, rotundatis; staminibus (immaturis) 1.1–1.3 cm. longis; ovario glabro.

KWANGSI: Yao Shan, Kam Shau, *C. Wang 39626* (TYPE), July 12, 1936, a tree 12 m. high, in mixed woods, flowers white.

This species is characterized by its relatively large flowers, which are subtended by two coriaceous bracts. It suggests no close relationship to other known species.

Adinandra serrulata sp. nov.

Frutex 3–8 m. altus, ramis striatis, ramulis novellis teretibus brunneis pubescentibus; foliis chartaceis, oblongo-lanceolatis, 14–17 cm. longis, 4–5 cm. latis, acutis vel acuminatis, basi late acutis vel subrotundatis, margine distincte serrulatis, supra viridibus glabris, subtus pallidioribus sparse pubescentibus, in sicco supra atro-olivaceis, subtus brunneo-olivaceis, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 15–22, gracilibus, utrinque conspicuis, venis tertiariis subconspicuis; petiolo circiter 1 cm. longo, pubescente; floribus solitariis axillaribus, pedicellis circiter 2 cm. longis, pubescentibus; sepalis coriaceis, ovatis, acutis, 10 mm. longis, 8 mm. latis, extus pubescentibus, intus glabris; petalis ovato-oblongis, late acutis, 12 mm. longis, 8 mm. latis, extus superne medium versus dense pubescentibus, prope marginem et inferne glabris; staminibus 7–9 mm. longis, filamentis glabris, connectivo leviter pubescente; ovario globoso, 4 mm. longo, dense pubescente, stylo crasso, 7 mm. longo, leviter pubescente, stigmate inconspicuo; fructu globoso, 2 cm. diametro, leviter pubescente, calyce persistente.

KWANGSI: Ling-wun District, *S. K. Lau 28705* (TYPE), July 19, 1937, a shrub 3 m. high, in woods, flowers white; Chen-pien District, *S. P. Ko 55926*, Oct. 17, 1935, a shrub 8 m. high, in woods, fruits deep red.

This species is characterized by its chartaceous oblong-lanceolate leaves, distinctly serrulate along the margins and sparsely pubescent beneath, its flowers with pubescent sepals and ovaries, and with petals densely pubescent outside on the median part above. It is probably nearest *Adinandra Bockiana* E. Pritz., from which it may be readily distinguished by the larger leaves, flowers, and fruits.

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NOTES ON SOME CULTIVATED TREES AND SHRUBS

Alfred Rehder

The following new combinations became necessary when, in compiling a Bibliography of cultivated trees and shrubs, it was found that, in a number of cases, older names overlooked or neglected by previous authors existed which called for a change in the nomenclature of certain groups. The numerous new cases of change of category without change of the combination itself, as changes from *varietas* to *forma* or, in general, changes from one subspecific category to another, e. g. *Rhododendron maximum* β. *album* Pursh to *R. maximum* f. *album* (Pursh) Fernald, will appear with full synonymy in the Bibliography referred to above, as "gradus novus."[1] As these changes of grade which mostly concern garden forms do not need any discussion or explanation and do not change the name itself, their publication prior to the publication in my Bibliography seems unnecessary; it would simply be a repetition of the numerous synonyms.

Taxus baccata L. f. **Dovastoniana** (Leighton), comb. nov.

Taxus baccata "Westfelton Yew" Loudon, Arb. Brit. 4: 2083, *fig. 1990* (1838).

Taxus baccata var. β. *Dovastoniana* Leighton, Fl. Shropshire, 497 (1841).

Taxus baccata var. β. *Dovastoni* Knight & Perry, Syn. Conif. 52 (1850), nom. — Lindley & Gordon in Jour. Hort. Soc. Lond. 5: 227 (1850), nom. — Hort. ex Lawson, List Pl. Fir Tribe, 81 (1851) "var." — Hort. Angl. ex Carrière, Traité Conif. 518 (1855). — Voss, Vilmor. Blumengärt. 1: 1243 (1896) "subsp. *vulgaris* f. *dovastoni*." — Pilger in Engler, Pflanzenreich, IV. 5(Heft 18): 114 (1903); in Mitt. Deutsch. Dendr. Ges. 1916(25): 11 [1917] "f. *Dovastonii*."

Taxus disticha Wenderoth, Pflanz. Bot. Gärt. 1(Conif.): 42 (1851). — Henkel & Hochstetter, Syn. Nadelh. 354 (1865), pro syn.

Taxus Dovastoni Hort., *T. imperialis* Hort., *T. pendula* Hort., *T. horizontalis* Hort., *T. umbraculifera* Hort., *T. baccata horizontalis* Hort. ex Henkel & Hochstetter, l. c. (1865), pro syn.

In almost all publications listing this form, the subspecific epithet has been spelled "*Dovastoni*," because the first publication of the form has been generally overlooked.

Pinaceae subfam. **Taxodioideae**, comb. nov.

Coniferae ord. 1. *Cupressineae* § 5. *Taxodineae* Endlicher, Syn. Conif. 6 (1847).

[1] For a note on the term "gradus novus," new grade, see this Journal 22: 570, footnote (1941). The term "status novus" was proposed by Bailey (in Gent. Herb. 1: 8) as a new term for a change of rank, to distinguish it from a transfer without change of rank which he proposed to call "translatio nova," new transfer, to be applied to transfers of names without change of rank from one genus to another or, in the case of subspecific names, from one species to another; both kinds of change are usually called "combinatio nova," new combination. The term "gradus novus," new grade, refers to changes of one subspecific grade to another under the same binomial and without change of the subspecific epithet, and therefore without change of the ternary combination itself, as in the example given above.

Coniferae ord. II. *Cunninghamieae* § 3. *Cunninghamieae* Endlicher, op. cit. 80 (1847) exclud. *Dammara*.

Coniferae trib. *Abietineae* subtrib. *Taxodieae* Parlatore in De Candolle, Prodr. 16, 2: 365 (1868).

Coniferae trib. *Taxodieae* Bentham & Hooker f., Gen. Pl. 3: 422 (1880).

Coniferae I. *Pinoideae* 1. *Abietineae* 1c. *Taxodiinae* Eichler in Nat. Pflanzenfam. II. 1: 65, 84 (1889).

Araucariaceae §. *Taxodieae* Engler, Syllab. Vorles. grosse Ausg. 62 (1892).

Taxodiaceae F. W. Neger, Nadelh. 24, 127 (Samml. Göschen, no. 355) (1907).—Pilger in Nat. Pflanzenfam. ed. 2, 13: 342 (1926).

Taxocupressaceae subfam. *Taxodioideae* Vierhapper in Abh. Zool.-Bot. Ges. Wien, 5, 4: 23 (1910).

Pinaceae subfam. *Abietoideae* trib. *Taxodieae* Ascherson & Graebner, Syn. Mitteleur. Fl. ed. 2, 1: 280, 355 (1912).

Pinaceae §. *Taxodieae* Engler, Syllab. Vorles. ed. 9, 122 (1924).

As according to the Rules of Nomenclature (Art. 24) the ending of names of subfamilies is -oideae, Vierhapper's name under *Taxocupressaceae* will be the correct name when this subfamily is transferred to *Pinaceae*, since the citation of the parenthetical author is not necessary. According to the Rules, in a transfer of the name of a division of higher rank than genus, the citation of the parenthetical author is not required (see Art. 49).

Chamaecyparis obtusa f. **Barronii**, nom. nov.

Retinispora tetragona R. Smith, Pl. Fir Tribe, 40 [1874?].—Barron ex Gordon, Pinet. ed. 2, 429 (1875).

Chamaecyparis thujaeformis [Hort.?] ex R. Smith, l. c. [1874?], pro syn.

Chamaecyparis obtusa var. *tetragona* (Gord.) Hornibrook, Dwarf Conif. 42 (1923), non Rehder (1919).

In 1919 (in Jour. Arnold Arb. 1: 52) I had proposed the ternary combination *C. obtusa* f. *tetragona* for the form with variegated foliage called by Nicholson *C. obtusa tetragona aurea*, adopting "*tetragona*" as the subspecific epithet to avoid coining an entirely new epithet, because *aurea* was preoccupied and no green form seemed to be known in cultivation at that time. In 1923, however, Hornibrook described the green form as *Ch. obtusa* var. *tetragona* (R. Smith), but that name, being invalidated by the earlier homonym of 1919, has to be changed; I propose the name *Ch. obtusa* f. *Barronii* in honor of William Barron of the Elvaston Nursery, who introduced this plant from Japan, as also did Mr. R. Smith of Worcester.

Juglans ailantifolia var. **cordiformis** (Maxim.), comb. nov.

Juglans cordiformis Maximowicz in Bull. Acad. Sci. St. Pétersb. 18: 62 (in Mél. Biol. 8: 63) (1873).

Juglans Sieboldiana var. *cordiformis* (Maxim.) Makino in Bot. Mag. Tokyo, 9: (313) (1895); 15: 94 (1901).

Juglans Allardiana Dode in Bull. Soc. Dendr. France, 1908: 34, *fig.* (1908).

Juglans coarctata Dode in op. cit. 1909: 36, *fig.* (1909).

Juglans Lavallei Dode in op. cit. 1909: 37, *fig.* (1909).

Juglans subcordiformis Dode in op. cit. 1909: 43, *fig.* (1909).

In an article dealing with homonyms (in Jour. Washington Acad. Sci. 23: 132. 1943), Little drew attention to the fact that the name *Juglans Sieboldiana* Maxim. (1873) is antedated by *J. Sieboldiana* Göppert (1855), based on a fossil plant. Therefore, the next oldest name for the species

described by Maximowicz had to be taken up; this is *J. ailantifolia* Carrière in Rev. Hort. 1878: 414, *fig. 85–86* (1878). Carrière, when coining the specific epithet, apparently followed De Candolle in the spelling of the generic name. De Candolle has it as *Ailantus* (in his Prodr. 2: 88. 1825), which probably is more correct than Desfontaines' spelling, because the name is derived from Ailanto, its native name in the Moluccas.

Hamamelis intermedia (*H. japonica* Sieb. & Zucc. × *mollis* Oliver), hybr. nov.

A *Hamamelide japonica* differt ramulis pubescentibus; foliis supra initio sparse stellato-pubescentibus maturis fere glabris, subtus initio satis dense stellato-pubescentibus, demum glabrescentibus; petiolis pubescentibus; petalorum parte inferiore plerumque rubris vel rubescentibus; capsula subglobosa vel late ovoidea ad 1.2 cm. diam., paulo longiora quam lata apice vix attenuata calyce plus quam tertiam partem fructus aequante.

A *H. molli* differt ramulis demum glabrescentibus vel glabris; foliis plerisque obovatis, basin versus plus minusve angustatis, ima basi inaequilateraliter truncatis vel late cuneatis, raro uno latere subcordatis, supra initio pubescentibus demum glabris vel fere glabris, subtus initio stellato-pubescentibus, demum plerumque glabrescentibus, petiolis gracilioribus glabris vel leviter pubescentibus; capsula apice minus distincte quadrangulari.

CULTIVATED SPECIMENS: Arnold Arboretum, no. *1173–28, A. Rehder,* April 6, 1935, *E. J. Palmer,* March & August, 1936; no. *1174–28, E. J. Palmer,* March & June, 1938 and Sept. 1940, *A. Rehder,* June, 1939 and Oct. 1944; no. *726–29* (seed as *H. mollis* from N. Kidder, Milton, Mass.), *E. J. Palmer,* June 10, 1938.

This hybrid was first raised at the Arnold Arboretum in 1929, from seed collected the previous year from a plant of *Hamamelis mollis* received from Veitch and raised from seed sent to Veitch by Maries in 1878, and from a plant of the same species raised from seed collected by Wilson in 1907 and sent to the Arnold Arboretum. None of the seedlings from the plants cultivated at the Arnold Arboretum turned out to be true *H. mollis;* all proved to be intermediate between *H. mollis* and *H. japonica,* of which several varieties were growing in the Arboretum. The hybrid also appeared in some other places, as in the author's garden where the two parent species were standing side by side, and spontaneous seedlings appeared almost every year and always proved to be hybrids. The plants raised showed considerable variation in the amount of pubescence, size and shape of the leaves and the color of the flowers, but they all agreed in being intermediate in various degrees between the two parent species. The most striking difference between these lies in their pubescence, *H. mollis* having the under surface of the leaves covered with a dense stellate tomentum which persists until autumn, while *H. japonica* has the leaves quite glabrous on both sides or pubescent beneath only when young, glabrous and somewhat lustrous light green beneath, or pubescent only at the veins at maturity, lustrous and darker green above and of firmer texture than *H. mollis,* which has leaves of softer texture, coloring a clear yellow, and dropping earlier than those of *H. japonica.* The leaves of *H. mollis* are broad at the oblique base and deeply cordate or sometimes subcordate, while in *H. japonica* they are usually more or less narrowed toward the oblique base

and broadly cuneate to truncate on one side and truncate to subcordate on the other. The flowers are similar in both species, with the petals bright yellow and reddish toward the base in *H. mollis* and bright yellow in *H. japonica* except in var. *flavo-purpurascens* (Mak.) Rehd., which has red or reddish petals, at least below the middle. The capsule in *H. mollis* is densely tomentose, larger and about as broad as high, 10–13 mm. across, with a broad truncate four-cornered apex and with a calyx enclosing the fruit more than $\frac{1}{3}$ to nearly $\frac{1}{2}$. In *H. japonica* the capsule is closely and more thinly pubescent, nearly ovoid, about 8 mm. across and somewhat narrowed toward the less strongly four-cornered apex, and the calyx encloses the capsule about $\frac{1}{3}$ or sometimes more.

Clematis dioscoreifolia Léveillé & Vaniot in Repert. Sp. Nov. Reg. Veg. 7: 339 (1909). *Clematis paniculata* var. *dioscoreifolia* (Lévl. & Vant.) Rehder in Jour. Arnold Arb. 1: 195 (1920).

Clematis dioscoreifolia Lévl. & Vant. var. **robusta** (Carr.), comb. nov.

Clematis Vitalba "aus Japan" Christmann, Pflanzensyst. 7: 309, *t. 55, fig. 2* (1781).

Clematis crispa sensu Thunberg, Fl. Jap. 239 (1784), non Linnaeus (1753).

Clematis virginica sensu Thunberg, Fl. Jap. 240 (1784), non *C. virginiana* Linnaeus (1762).

Clematis paniculata Thunberg in Trans. Linn. Soc. Lond. 2: 337 (1794). — Rehder & Wilson in Sargent, Pl. Wilson. 1: 331 (1913). — Non J. F. Gmelin (1791) [= *C. indivisa* Willd.]

Clematis Flammula robusta Carrière in Rev. Hort. 1874: 465, *fig. 59* (1874); 1899: 529, *fig. 227* (1899). — Rehder & Wilson, l. c. (1913), pro syn.

Clematis recta π. *paniculata* Kuntze in Verh. Bot. Ver. Brandenb. 26(Abh.): 115 (Monog. Clemat.) (1885).

Clematis recta sensu Finet & Gagnepain in Bull. Soc. Bot. France, 50: 535 (1903); Contrib. Fl. As. Or. 1: 20 (1905); non Linnaeus (1753).

This ornamental vine, much planted for its profuse white flowers appearing in autumn, and until now well known under the name *C. paniculata* Thunb., unfortunately must change its name, since that name is a later homonym of *C. paniculata* J. F. Gmelin in Linnaeus, Syst. Nat. ed. 13, 3,1: 873 (1791). Gmelin's name, based on *C. integrifolia* Forster, Fl. Ins. Austral. Prodr. 42 (1786), non Linnaeus (1753), however, was not taken up by Willdenow, who gave to *C. integrifolia* Forst. the name *C. indivisa* in his Sp. Pl. 2,2: 1291 [1800]. Willdenow probably overlooked Gmelin's name or intentionally omitted it, because he adopted in the same publication Thunberg's *C. paniculata* as a valid name, which will have to replace *C. indivisa* Willdenow of 1800; both names are based on the same species, namely *C. integrifolia* Forster, non Linnaeus, and Gmelin's name has nine years' priority. It seems strange that in none of the New Zealand floras does the name *C. paniculata* Gmel. appear, not even as a synonym, though *C. indivisa* is described as a valid species. When, in 1920, I referred *C. dioscoreifolia* Lévl. & Vant. as a variety to *C. paniculata,* Art. 61 of the Rules (containing the so-called homonym rule) was not yet in force, not having been adopted until 1930 (ed. 3, p. 19).

There seems to be no earlier name to replace *C. paniculata* Thunb., non Gmelin, except *C. dioscoreifolia* Léveillé & Vaniot, representing a plant somewhat different from *C. paniculata* Thunb., but undoubtedly con-

specific. Therefore, it will have to be accepted as the correct name for this species and *C. paniculata* Thunb. treated as a variety, for which the varietal name will be "*robusta*," described and figured by Carrière in 1874 as *C. Flammula robusta*. Eleven years later Kuntze named this plant *C. recta* π. *paniculata*, which would be preferable as a varietal name, since the plant has been well known for a long time as *C. paniculata* Thunb.; but the latter is, according to Carrière's description, clearly the same plant as *C. Flammula robusta*, overlooked by Kuntze and not mentioned at all in his monograph, but cited as a synonym of *C. paniculata* in Sargent, Pl. Wilson. 1: 331 (1913).

Crataegus ser. **Crus-gallianae**, nom. nov.

Crataegus §. IV. *Crus-galli* Loudon, Arb. Brit. 2: 820 (1838). — Sargent in Rhodora, 3: 19 (1901); Silva N. Am. 1: 32 (1902). — Schneider, Ill. Handb. Laubh. 1: 769, 796 (1906) "sect.". — Rehder, Man. Cult. Trees Shrubs, 368 (1927) "group"; ed. 2, 364 (1940) "ser."

Crataegus . . . *Berberifoliae* Beadle in Biltmore Bot. Stud. 1: 127 (1902); in Small, Fl. Southeast. U. S. 533 (1903); nom. subnud.

Crataegus "Gruppe" *Crura galli* Zabel in Beissner et al., Handb. Laubh.-Ben. 171 (1903).

The name *Crataegus* §. *Crus-galli* Loudon given to a subdivision of *Crataegus* is contrary to Art. 4 of the Rules of Botanical Nomenclature, since it is ambiguous and may cause error, because the combination does not differ from the binary combination of a species, in this case *C. crus-galli* L., the type of this series. Therefore, the name is herewith changed to an adjective in plural form, which is the recommended form for names of series (see Art. 26 of the Rules of Botanical Nomenclature), to make it conform to the names of the other series of this genus.[2]

Crataegus . . . *Berberifoliae*, a *nomen subnudum* published without indication of category, as a subdivision different from ser. *Crus-gallianae* does not seem to be sufficiently distinct and is here enumerated as a synonym.

Amelanchier canadensis (L.) Med. var. **micropetala** (Robins.), comb. nov.

Amelanchier oblongifolia var. *micropetala* Robinson in Rhodora, 10: 33 (1908).

Amelanchier Botryapium var. *micropetala* (Robins.) Farwell in Rep. Michigan Acad. Sci. 17: 176 (1915).

Fernald, in Rhodora 43: 566 (1941), has shown that the type of *Amelanchier canadensis* (L.) Med. is the plant generally called *Amelanchier oblongifolia* Roemer, while *A. canadensis* of Sargent and most American authors will have to bear the name *A. arborea* (Michx.) Fernald (in op. cit. 563). This makes necessary the transfer proposed above.

Zanthoxylum L. subgen. **Thylax** (Raf.), comb. nov.

Fagara Duhamel, Traité Arb. Arbust. 1: 229, *t. 97* (1755).

Zanthoxylum Linnaeus, Syst. Nat. ed. 10, 2: 1290 (1759), p. p. quoad *Fagara* Duhamel; non Linnaeus (1753).

Thylax Rafinesque, Med. Bot. 2: 114 (1830).

Zanthoxylum sect. *Zanthoxylum* G. Don, Gen. Hist. Dichlam. Pl. 1: 801 (1831), non *Zanthoxylum* L. (1753), p. p.

[2] See also my proposal (in Jour. Arnold Arb. 20: 269. 1939) concerning a change of Art. 26 for the 7th Botanical Congress in Stockholm planned for 1940.

Mioptrila Rafinesque, Am. Man. Mulberry, 37 (1839).

Zanthoxylum a. *Euzanthoxylum* Endlicher, Gen. Pl. 1146 (1840). — Schneider, Ill. Handb. Laubh. 2: 118 (1907). — Non *Zanthoxylum* L. (1753).

Xanthoxylum Engler in Nat. Pflanzenfam. III. 4: 115 (1896). — Graebner in Ascherson & Graebner, Syn. Mitteleur. Fl. 7: 237 (1914). — Non *Zanthoxylum* L. (1753).

The oldest name, *Fagara* Duhamel (not listed in Index Kewensis), cannot be taken up as a subgeneric name for this subgenus, since it has been already used for another subdivision of the genus, namely *Z.* sect. *Fagara* G. Don, Gen. Hist. Dichlam. Pl. 1: 802 (1831), based on *Fagara* Linnaeus, Syst. Nat. ed. 10, 2: 897 (1759). The next oldest generic name available for this group is *Thylax* Rafinesque, with the species *T. fraxineum* Raf. (= Z. *americanum* Mill.), which is here proposed as the name for the subgenus typified by *Z. americanum* Mill. The subgeneric names sect. *Zanthoxylum* G. Don (1831) and *Z.* a. *Euzanthoxylum* Endlicher (1840) cannot be used for this subgenus, since they would imply that these groups are based on the type of the genus, which is not the case, since the type species is undoubtedly *Z. Clava-herculis* L. *Zanthoxylum* Linnaeus, Sp. Pl. 270 (1753) contains only two species: 1. Z. *Clava-herculis* and 2. *Z. trifoliatum* (= *Acanthopanax trifoliatus* (L.) Merr.) Therefore *Z. Clava-herculis* must be considered the type of the genus, though in 1759, Linnaeus (Syst. Nat. ed. 10, 2: 1290) cites, besides Hortus Cliffortianus 487 and Catesby Car. 1, p. 26, *t.26,* also *Fagara* Duhamel of 1754, which represents *Z. americanum* Mill. In his Genera Plantarum ed. 5, 130 (1754), Linnaeus describes *Zanthoxylum* as having no corolla, although in Hortus Cliffortianus he states that it has a small 5-parted perianth and a pentapetalous corolla with 5 ovate-oblong petals; also the figure of Catesby shows distinctly a double perianth and *Z. trifoliatum* has a double perianth.

In 1759 (Syst. Nat. ed. 10, 2: 897, 1290) Linnaeus recognizes two genera, *Fagara* and *Zanthoxylum,* chiefly distinguished by the number of stamens, four in the former, five in the latter genus, by bisexual or polygamous flowers and double perianth in *Fagara* and by dioecious flowers and simple perianth in *Zanthoxylum,* but the character of the perianth does not hold, since all the species enumerated have a double perianth and the number of stamens varies from three to eight. The species taken by all later authors as typical of *Zanthoxylum,* namely *Z. americanum* Mill. (*Z. fraxineum* Willd.), was only imperfectly known to Linnaeus and not recognized as a species, but only cited in synonymy as *Fagara* Duham., which according to Duhamel's figure represents without doubt the species later described as *Z. americanum* Mill. For the subgenus to which *Z. Clava-herculis* L. belongs, the correct name will be *Z.* subgen. *Fagara* (L.) Schneider (*Z.* sect. *Fagara* G. Don), based on *Fagara* Linnaeus (1759). If, however, the two subgenera are considered different genera, *Zanthoxylum* will be the generic name for *Z.* subgen. *Fagara* (L.) Schneid., and for *Z.* subgen. *Thylax* the generic name will be *Fagara* Duham. (1754). This just reverses Engler's arrangement and would create confusion which could only be avoided by

conserving *Fagara*, which is by far the larger group in the sense of Linnaeus (1759) as amplified by Engler [1896], and accepting *Thylax* Raf. as the name for the genus typified by *Z. americanum* Mill., or by conserving both names in the sense of Engler. The two genera are close and none of the characters are strong enough for generic separation, so it seems preferable to consider them subgenera or sections of one genus, as done by most authors.

Rhododendron glaucophyllum, nom. nov.

Rhododendron glaucum Hooker f., Rhodod. Sikkim-Himal. 18, *t. 17* (1851). — Hutchinson in Rhodod. Soc., Rhodod. Sp. 300, *fig.* (1930). — Non Sweet (1830).

Rhododendron glaucum Hooker, being invalidated by the earlier homonym of *R. glaucum* (Lam.) Sweet, Hort. Brit. ed. 2, 344 (1830), has to receive a new name, since no other is available.

Rhododendron flavum [Hoffmanns.] G. Don, Gen. Hist. Dichlam. Pl. 3: 847 (1834). — Kuznetzov, Fl. Cauc. Crit. 4, 1: 31, 488 [1901, 1906]. — Non Pallas (1776), nom.

Azalea pontica Linnaeus, Sp. Pl. 150 (1753), non *R. ponticum* L. (1753).

Azalea arborea Linnaeus ex Linnaeus, Sp. Pl. ed. 2, 2: 1669 (1764), pro syn.

Azalea flava Hoffmannsegg, Verz. Pflanzenkult. Nachtr. 2: 62 (1826).

Anthodendron ponticum Reichenbach in Mössler, Handb. Gewächsk. ed. 2, 1: 308 (1827).

Rhododendron luteum Sweet, Hort. Brit. ed. 2, 343 (1830). — Wilson in Wilson & Rehder, Monog. Azalea, 103 (1921), non *Azalea lutea* Linnaeus (1753).

Rhododendron flavum var. *coronarium* Sweet, Brit. Flow. Gard. ser. 2, 4: *t. 331* (1836).

Rhododendron ponticum Schreber ex De Candolle, Prodr. 7, 2: 718 (1839), pro syn.; non Linnaeus (1762).

Azalea pontica α. *flava* De Candolle, l. c. (1839).

Anthodendron flavum Reichenbach ex K. Koch, Dendr. 2, 2: 184 (1872), pro syn.

Although this is not a new combination, it is enumerated here with complete synonymy to show that *R. flavum* is the correct name for the species usually called *R. luteum*. By Schneider (Ill. Handb. Laubh. 2: 500. 1911) the name *R. luteum* was applied to *R. calendulaceum* (Michx.) Torr., but that combination is invalidated by the older homonym of Sweet.

Rhododendron flammeum (Michx.) Sargent in Rhodod. Soc. Notes, 1, 3 (1917): 120 [1918].

?*Azalea flammea* Bartram, Travels N. & S. Carol. 323, 327 (1791), nom. subnud.

Azalea nudiflora α. *coccinea* Aiton, Hort. Kew. 1: 202 (1789). — Curtis in Bot. Mag. 5: *t. 180* (1792).

Azalea coccinea Curtis, l. c. (1792), pro syn. — Michaux, Jour. ed. C. S. Sargent in Proc. Am. Philos. Soc. 26: 9 (1889), nom.

Azalea fulva Michaux in Jour. Hist. Nat. 1: 410 (1792), nom. — Rehder in Jour. Arnold Arb. 4: 6 (1923), pro syn.

Azalea calendulacea α. *flammea* Michaux, Fl. Bor.-Am. 1: 151 (1803). — Pursh, Fl. Am. Sept. 1: 152 (1814).

Azalea speciosa Willdenow, Berlin. Baumz. ed. 2, 49 (1811). — Guimpel, Otto & Hayne, Abb. Fremd. Holzart. 1: 37, *t. 31* (1825).

Azalea periclymenoides α. *coccinea* Pursh, Fl. Am. Sept. 1: 152 (1814).

Azalea nudiflora sensu Loiseleur, Herb. Gén. Amat. 4: 213, *t.* (1820), non Linnaeus (1762).

Azalea calendulacea var. a. Elliot, Sketch Bot. S. Carol. 1: 239 (1821), p. p.
Azalea coccinea major Loddiges, Bot. Cab. 7: *t. 624* (1822).
Azalea speciosa α. *major* Sweet, Hort. Brit. 265 (1826).
?*Azalea nudiflora* var. *thyrsiflora* Gowen ex Lindley in Bot. Reg. 16: *t. 1367* (1830).
Rhododendron speciosum Sweet, Hort. Brit. ed. 2, 343 (1830), p. p., quoad "α. *major*." — G. Don, Gen. Hist. Dichlam. Pl. 3: 848 (1834). — Rehder in Wilson & Rehder, Monog. Azal. 131 (1921). — Non Salisbury (1796).
Rhododendron nudiflorum ζ. *coccineum* Sweet, l. c. (1830). — G. Don, op. cit. 847 (1834).
Azalea speciosa α. *coccinea* De Candolle, Prodr. 7, 2: 717 (1839).
Azalea calendulacea sensu Darby, Bot. S. Stat. 422 (1855), p. p. ; non Michaux (1803).
Rhododendron calendulaceum sensu Chapman, Fl. S. U. S. 265 (1860), p. p. ; non Torrey (1824).
Rhododendron calendulaceum f. *speciosum* Voss, Vilmor. Blumengärt. 1: 588 (1894).

Like the preceding species, this does not represent a new combination. It is enumerated here with complete synonymy to show that *R. flammeum* is its correct name; it is not listed in Index Kewensis. The species has been known for a long time as *R. speciosum* (Willd.) Sweet, but has been confused particularly with the red-flowered form of *R. calendulaceum* (Michx.) Torrey, from which it differs chiefly in the shape and pubescence of the corolla-tube; also the geographical distribution of the two species is different, *R. calendulaceum* being a plant of the Appalachian Mountains region from Pennsylvania to northern Georgia, while *R. flammeum* is found in the coastal plain region from central Georgia to South Carolina. Unfortunately, the name *R. speciosum* (Willd.) Sweet (*Azalea speciosa* Willd.), under which this species has been known for some time, is a later homonym of *R. speciosum* Salisb., which, although it is only a renaming of *R. ponticum* L. and therefore illegitimate, invalidates the later *R. speciosum* Sweet according to Art. 61 of ed. 3 of the Rules of Botanical Nomenclature adopted in 1930. For further details concerning this species, see my remarks in Wilson & Rehder, Monograph of Azaleas, 131–134 (1921).

Syringa laciniata Miller, Gard. Dict. ed. 8, *S.* no. 3 (1768). — Duroi, Harbk. Baumzucht, 2: 447 (1772). — K. C. Gmelin, Fl. Badens. 1: 14 (1805).
Syringa persica β. Linnaeus, Sp. Pl. 9 (1753).
Syringa persica 4. *laciniata* Weston, Bot. Univ. 1: 289 (1770). — Aiton, Hort. Kew. 1: 15 (1789) "γ". — Voss, Vilmor. Blumengärt. 1: 653 [1895], as forma. — McKelvey, Lilac, 450, *t. 140–147* (1928), var. — Rehder, Man. Cult. Trees Shrubs, ed. 2, 782 (1940), var.
Syringa capitata S. G. Gmelin, Reise Russl. 3: 304, *t. 32, fig. 1* (1774).
Lilac persica β. Lamarck, Encycl. Méth. Bot. 3: 513 [1791].
Lilac Persica laciniata Dumont de Courset, Bot. Cult. 1: 709 (1802), as synon. — Mirbel in Duhamel, Traité Arb. Arbust. éd. augm. [Nouv. Duhamel], 2: 208 [1804].
Liliacum laciniata Rénault, Fl. Dépt. Orne, 100 (1804).
Siringa persica laciniata Thiriart, Cat. Pl. Arb. Jard. Bot. Cologne, sér. 3: 1 (1806), *Syringa* in indice.
Syringa persica γ. *pteridifolia* Bosse, Handb. Blumengärt. ed. 2, 3: 461 (1842). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 91 (1920) "α. *typica* f. *pt.*", nom.
Syringa persica var. *pinnata* Jacques in Ann. Fl. Pomone, sér. 2, 1: 274, *t.* (1843). — Lingelsheim, l. c. (1920) "var. *typica* f. *p.*", nom.

For numerous citations of additional literature and pre-Linnaean as well as additional horticultural synonyms not cited here, see McKelvey, Lilac, 450–452 (1928).

Syringa persica [*S. afghanica* × *laciniata*] Linnaeus, Sp. Pl. 9 (1753), exclud. β. — Miller, Gard. Dict., ed. 8, *S.* no. 2 (1768). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 90 (1920). — McKelvey, Lilac, 433 (1928).

Syringa persica α. Linnaeus, Sp. Pl. 9 (1753).

Syringa persica 3. *coerulea* Weston, Bot. Univ. 1: 289 (1770).

Lilac persica et *L. persica* α. Lamarck, Encycl. Méth. Bot. 3: 513 [1791].

Lilac minor Moench, Meth. Pl. 431 (1794).

Syringa angustifolia Salisbury, Prodr. Stirp. Chap. Allert. 14 (1796).

Lilac persica ligustrina Mirbel in Duhamel, Traité Arb. Arbust. éd. augm. 2: 207 [1804].

Syringa persica α. *integrifolia* Vahl, Enum. Pl. 1: 38 (1805).

Syringa persica var. *typica* Schneider, Ill. Handb. Laubh. 2: 775, *fig. 485k-n, 486n-q* (1911). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 90 (1920), p. p.

For numerous citations of additional literature and pre-Linnaean as well as additional horticultural literature not cited here, see McKelvey, Lilac, 433–436 (1928).

When Dr. Sax showed me the manuscript of his paper on "Lilac species hybrids," published in this number of the Journal, my attention was again drawn to the fact that *S. persica* is highly or completely sterile and that it never had been found wild in any country. Already Schneider in 1903 (in Wien. Ill. Gartenzeit. 28: 90), discussing the origin of *S. persica,* voices the opinion that it might be a hybrid of his *S. afghanica,* first described in the paper cited, and suggests that the other parent might be a cross of *S. vulgaris.* The spontaneous occurrence of *S. persica* var. *laciniata* in northwestern China was not known at that time, and Schneider (in his Ill. Handb. Laubh. 2: 775. 1911) states that the latter is possibly a variety of *S. afghanica* originated in cultivation. In regard to the origin and the greatly varying opinion about the valuation of *S. persica* and related forms, Mrs. McKelvey gives ample and detailed accounts in her monumental work "The Lilac" on pages 428–431, 436–445 and 452–459. As there can hardly be any doubt that the group generally called *S. persica* is a heterogeneous concept consisting of two different elements, a spontaneous species and a hybrid originated in cultivation, it cannot be maintained as a taxonomic unit, but should be separated as done above into the spontaneous species *S. laciniata* Mill. and the hybrid *S. persica* L. The hybrid apparently originated in Persia, whence *S. laciniata* had been introduced from northwestern China and *S. afghanica* from Afghanistan, although there is no actual proof, as far as I know, that *S. afghanica* had been in cultivation in Persia. *Syringa laciniata* seems to have a much wider distribution in cultivation; besides a specimen from Persian gardens there are in this herbarium specimens from gardens in Honan and Chile and a fragment from a specimen collected in Kashmir (*Srinuggur 5200*), grown as a hedge plant. In Honan it has apparently hybridized with *S. oblata* Lindl., for a specimen from a garden in Chengchow (*Hers 196,* April 24, 1921) is

unmistakably intermediate between *S. oblata* and *S. laciniata*. This specimen has the large inflorescence and flowers with the stamens inserted much below the mouth as in *S. oblata* and leaves predominantly similar to those of *S. oblata*, only smaller and narrower and on one branch partly trifoliolate with acute oblong to elliptic leaflets, suggestive of those of *S. laciniata*. This specimen is also mentioned by Mrs. McKelvey under *S. chinensis* (Lilac, p. 404), but the insertion of the anthers shows clearly that it has nothing to do with *S. chinensis* or *S. vulgaris*. There is no evidence that *S. vulgaris* was cultivated in China or in Persia. It was introduced from southeastern Europe to western European gardens by way of Constantinople and was probably not known in Asiatic gardens before the twentieth century.

Since the account of the subdivision of *Syringa* in 1928 in McKelvey, The Lilac, p. 11, I have made some slight changes in the evaluation of the groups and added a new series. The incompatability, as shown by Sax (see p. 80 of this issue), of the species of subser. *Euvulgares* and those of subser. *Pubescentes* has led me to elevate the latter to the rank of series. The new series, *Pinnatifoliae*, proposed in 1922, is closely related to the ser. *Vulgares* and hybridizes with species of that series, but on account of such obvious morphological characters as pinnate leaves and the presence on the flowering branches of a terminal bud developing into a leafy shoot, it seems preferable to maintain it as a series.

With these changes the subdivisions of *Syringa* will be as follows:

Subgen. I. EUSYRINGA K. Koch, Dendr. 2, 1:.265 (1872). — Knoblauch in Nat. Pflanzenfam. IV. 2: 8 [1892] "sect." — Rehder in McKelvey, Lilac, 11 (1928) "sect."

Ser. 1. VILLOSAE Rehder in McKelvey, l. c. (1928). — Rehder, Man. Cult. Trees Shrubs, 777 (1940).

Syringa subgen. *Eusyringa* sect. *Villosae* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 80 (1910) "sect.", nom. subnud.; Ill. Handb. Laubh. 2: 778 (1911) "sect." — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 75 (1920) "subsect."

Ser. 2. PUBESCENTES Lingelsheim in op. cit. 87 (1920) "subsect. *Vulgares* ser. *P.*"

Syringa subgen. *Eusyringa* sect. *Vulgares* subsect. *Pubescentes* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 80 (1910), nom. subnud.; Ill. Handb. Laubh. 2: 772 (1911). — Rehder in McKelvey, Lilac, 11 (1928) "sect. *Eusyringa* ser. *Vulgares* subser. *Pubescentes*."

Ser. 3. VULGARES Rehder in McKelvey, Lilac, 11 (1928) "sect *E.* ser. *V.*", exclud. subser. *Pubescentes*.

Syringa subgen. *Eusyringa* sect. *Vulgares* subsect. *Euvulgares* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 79 (1910), nom. subnud.; Ill. Handb. Laubh. 2: 772 (1911). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 87 (1920) "sect. *Eusyringa* subsect. *Vulgares* ser. *Euvulgares*."

Ser. 4. PINNATIFOLIAE Rehder in Jour. Arnold Arb. 20: 427 (1939).

Subgen. II. LIGUSTRINA (Rupr.) K. Koch, Dendr. 2, 1: 271 (1872).

Syringa sect. *Ligustrina* Ruprecht in Bull. Phys. Math. Acad. Sci. St. Pétersb. 15: 371 (in Mél. Biol. 2: 551) (1857). — Maximowicz in Mém. Div. Sav. Acad. Sci. St. Pétersb. 9: 193 (Prim. Fl. Amur.) (1859). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 92 (1920). — Rehder in McKelvey, Lilac, 12 (1928).

Ligustrina (Rupr.) Ruprecht in Beitr. Pflanzenk. Russ. Reich. 11: 55 (1859). — Maximowicz in Bull. Acad. Sci. St. Pétersb. 20: 432 (in Mél. Biol. 9: 395; Diagn. Pl. Nov. Jap. Mandsh. dec. XIX) (1875).

Syringa oblata Lindl. var. **dilatata** (Nakai) Rehd. f. **pendula**, f. nova.

A *S. oblata* var. *dilatata* differt ramis ramulisque pendulis saepe leviter flexuosis.

CULTIVATED SPECIMENS in Herb. Arnold Arb.: Hort. Mrs. Daniel C. Hunt, Haverhill, Mass., *D. Wyman,* Oct. 12, 1938 (with photograph showing the habit) and May 23, 1940 (flowering branch); Arnold Arb. no. *291–40* (cutting from the original plant), *A. Rehder,* Oct. 2, 1944.

The photograph of the plant in the garden of Mrs. Hunt shows a shrub of globose outline with spreading pendulous branches often more or less wavy and about 1.5 m. tall at the time; the plant in the Arnold Arboretum is of similar shape but smaller. The original plant was obtained by Mrs. Hunt about 1926 from the Kelsey Nurseries in Boxford, Mass., where it must have been raised from seed sent by E. H. Wilson from Korea in 1917 to the Arnold Arboretum as *Syringa* spec., the first introduction of *S. oblata* var. *dilatata* into cultivation. The plant obtained by Mrs. Hunt was apparently the only one showing a pendulous habit; none of the plants raised at the Arboretum from Wilson's seed showed any variation in habit.

Lavandula officinalis L. f. **alba** (Gingins-Lass.), comb. nov.

Lavandula vera β. alba De Gingins-Lassaraz, Hist. Nat. Lavandes, 147 (1826).

Lavandula Spica β. alba Sweet, Hort. Brit. 316 (1827), nom. subnud.; non Weston (1770).

Lavandula officinalis f. *albiflora* Rehder in Jour. Arnold Arb. 20: 428 (1939).

When in 1939 (l.c.) I published the new name *Lavandula officinalis* f. *albiflora,* because *L. Spica β. alba* Sweet is invalidated by the earlier homonym of Weston, which represents a form of a different species, namely *L. latifolia* DC., I did not know of the publication by Gingins-Lassaraz in 1826 of *L. vera β. alba* containing the subspecific epithet *alba* in a validly published combination, one year earlier than the invalid *L. Spica β. alba.*

Viburnum plicatum Thunb. f. **tomentosum** (Thunb.), grad. nov.

Viburnum tomentosum Thunberg, Fl. Jap. 123 (1784). — Rehder in Sargent, Trees Shrubs, 2: 108 (1908); Man. Cult. Trees Shrubs, ed. 2, 835 (1940). — Non Lamarck (1778), nec Rafinesque (1808), nec Hance (1870).

Viburnum plicatum sensu Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 266 (Prol. Fl. Jap. 154) (1866), non Thunberg (1794).

Viburnum plicatum γ. tomentosum Miquel, l. c. (1866).

Viburnum tomentosum f. *typicum* Zabel in Beissner et al., Handb. Laubh.-Ben. 441 (1903).

As *Viburnum tomentosum* Thunb. is invalidated by the earlier homonym *V. tomentosum* Lam. (1778), the next oldest valid binomial has to be taken up, in this case *V. plicatum* Thunberg in Trans. Linn. Soc. Lond. 2: 332 (1794), which represents the double-flowered form of the species named by Thunberg ten years earlier *V. tomentosum.* Thus a teratological garden form becomes the nomenclatural type of *V. plicatum,* to which all the names of the double-flowered form are referable as synonyms except *V. plicatum* f. *rotundifolium,* which is best considered a distinct form, while the phylogenetic type represented by *V. tomentosum* becomes a form of *V. plicatum.*

Similar cases occur in the genus *Rosa,* where in several instances the double-flowered form was known and named earlier than the wild single-flowered phylogenetic or biological type.

Viburnum plicatum f. **rotundifolium** (Rehd.), comb. nov.
Viburnum tomentosum var. *rotundifolium* Hort. ex Rehder in Bailey, Cycl. Am. Hort. [4]: 1925 (1902); in Sargent, Trees & Shrubs, 2: 108 (1908) "f."

This form differs from the type of *V. plicatum* only in the broader leaves and in the flowers appearing about two weeks earlier.

Viburnum plicatum f. **Mariesii** (Veitch), comb. nov.
Viburnum tomentosum Mariesii Veitch in Jour. Hort. Soc. Lond. 27: 860, *fig. 195* (1902) "var." *sub fig.*

This form differs from *V. plicatum* f. *tomentosum* only in the larger cymes and larger flowers.

Viburnum plicatum var. **lanceatum** (Rehd.), comb. nov.
Viburnum tomentosum var. *lanceatum* Rehder in Sargent, Trees & Shrubs, 2: 109 (1908).

This variety is similar to *V. plicatum* var. *parvifolium* Miquel, but differs chiefly in the narrower, more gradually acuminate leaves, lanceolate on the shoots and more densely stellate-pubescent beneath.

Gramineae subfam. **Bambusoideae**, comb. nov.
Gramina . . . Bambusacea Kunth in Mém. Mus. Hist. Nat. Paris, 2: 75 (1815).
Gramineae IX. *Bambusinae* Agardh. Aphor. Bot. 153 (1817).
Gramineae sect. *Bracteaeflorae* Link, Handb. Erkenn. Gew. 1: 95 (1829).
Gramineae 10. *Bambuseae* Kunth ex Lindley, Introd. Nat. Syst. Bot. 304 (1830). — Hackel in Nat. Pflanzenfam. II. 2: 89 (1887) *"Gramineae* trib. *B."*
Bambusaceae Link, Hort. Berol. 2: 308 (1833). — Nakai, Fl. Sylv. Kor. 20: 11 (1933).
Gramineae subtrib. *Bambusaceae* Endlicher, Gen. Pl. 102 [1836]. — Steudel, Syn. Pl. Glum. 1: 329 (1855) "trib."
Gramineae trib. *Festucaceae* subtrib. *Bambuseae* Meissner, Pl. Vasc. Gen. 1: 425; 2: 325 (1843).
Graminaceae D. *Festucinae* d. *Bambuseae* Horaninov, Char. Ess. Fam. Reg. Veg. 35 (1847).
Gramina subfam. *Bambusoideae* Ascherson & Graebner, Syn. Mitteleur. Fl. 2, 1: 769 (1902).

As *Gramineae* is a *nomen conservandum* with an alternative name ending in "aceae," the family name used by Ascherson & Graebner in combination with the subfam. *Bambusoideae* cannot be accepted and the new combination proposed above becomes necessary, if this subdivision of the family is considered a subfamily. In regard to the citation of the parenthetical author, see note under Pinaceae subfam. Taxodioideae (p. 68).

ARNOLD ARBORETUM,
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LILAC SPECIES HYBRIDS

Karl Sax

With one plate

There is a remarkable correlation between the taxonomic classification of the species of *Syringa* and the genetic affinities of the species. In Mrs. McKelvey's monograph (1928) of the lilacs, the genus was separated by Rehder into two sections, two series, and two subseries. No hybrids have ever been obtained from crosses between species of different sections, series, or subseries, but within these units there is considerable genetic compatability.

More recently, Redher (1945) has indicated that the sections are worthy of subgeneric rank, as *Eusyringa* and *Ligustrina*. The subgenus *Eusyringa* is divided into four series, the *Villosae, Pubescentes, Vulgares,* and *Pinnatifoliae*. The *Pinnatifoliae* have been separated from the *Vulgares* on morphological grounds, although there is considerable genetic compatability between these two series. The *laciniata* variety of *S. persica* has been raised to specific rank, and the typical *S. persica* and its entire-leaved varieties are now classed as hybrids. The nomenclature used in this survey is based upon Rehder's classification of the genus (McKelvey, 1928; Rehder, 1945).

Crosses have been made between various species of *Syringa,* but most of them have been made between rather closely related species. Improved types of lilacs of the *Villosae* series have been obtained from crosses between *S. Josikaea* and *S. villosa* made by L. Henry, and from crosses between *S. reflexa* and *S. villosa* which have produced the various forms of the *S. Prestoniae* hybrids. Within the *Vulgares* series crosses between *S. oblata* and *S. vulgaris* have given rise to the hybrid *S. hyacinthiflora* and to the various Lemoine hybrids, but these hybrids differ from the common lilacs only in the time of flowering and a few other minor characters. The only new distinctive types of lilacs of ornamental value have been obtained from crosses between *S. laciniata* and *S. vulgaris*.

Within the subgenus *Eusyringa* there is more or less genetic compatability between species. In the *Villosae* series there are nine species. All are of Asiatic origin with the exception of *S. Josikaea,* which is a native of the Carpathian Mountains. Five of the nine species, including *S. Josikaea,* have been used in various combinations to obtain species hybrids, and it is possible that all of the *Villosae* species are inter-fertile to some degree. However, even the species crosses which produce some vigorous hybrids also produce some abnormal plants. According to Miss Preston (McKelvey, 1928), the cross between *S. reflexa* and *S. villosa* results in a large proportion of dwarf and variegated progeny as well as plants which are very vigorous.

The species of the *Pubescentes* series are all of Asiatic origin and many of them are rather similar in general morphological characters; yet species hybridization in this group of lilacs is limited. During the past fifteen years we have attempted to combine the fragrance of *S. pubescens* with the more attractive flowers of *S. velutina, S. Potanini, S. microphylla,* and other species. Many of the crosses produce viable seeds, but the seedlings are albinos and soon die. Occasionally a variegated seedling survives but grows slowly. Several hybrid plants from the cross of *S. velutina* × *S. pubescens* have survived for ten years, but they are small and poorly developed. A cross between *S. pubescens* and *S. Potanini* produced a number of seedlings which are now two years old, but they lack vigor and probably will not survive. The only vigorous hybrid obtained in this subseries was from a cross between *S. Potanini* and *S. microphylla,* but this cross also produced some dwarf seedlings. It is possible that certain other combinations would also produce some vigorous hybrids, but as a group there is considerable incompatibility among the species of the *Pubescentes.*

The species of the *Vulgares* series include *S. vulgaris, S. oblata,* and *S. laciniata. Syringa vulgaris* is a native of southeastern Europe, while the other species are indigenous in China. There is considerable genetic affinity among these species. Crosses between *S. vulgaris* and *S. oblata* have produced many vigorous hybrids in the past and we have grown a number of second generation segregates. Both spontaneous and artificial hybrids of *S. vulgaris* and *S. laciniata* have been grown. According to Rehder (1945), a hybrid between *S. oblata* and *S. laciniata* has been found in a garden in Chengchow, China. We have obtained viable seeds from a cross between *S. laciniata* and a variety of *S. oblata.*

The series *Pinnatifoliae* is represented by a single species, *S. pinnatifolia.* Although this is a distinct species, it is rather closely allied to species of the *Vulgares* series. It produces hybrids with *S. oblata* varieties which are vigorous but sterile (Rehder, 1935). It is probable that it will also cross with *S. vulgaris.* We have obtained hybrids between *S. laciniata* and *S. pinnatifolia;* these hybrids are uniform and vigorous.

The hybrids of greatest horticultural value have been obtained from crosses between *S. laciniata* and *S. vulgaris.* The first hybrids were obtained from a spontaneous cross in the Botanical Garden at Rouen. In 1777 Varin, the director of the garden, planted open pollinated seeds of *S. laciniata* and obtained the hybrid first known as the Varin lilac or *S. rothomagensis,* and now known as *S. chinensis.* Varin did not recognize the progeny of the cut-leaved lilac as a natural hybrid of *S. laciniata* × *S. vulgaris,* but considered it as the normal progeny of a degenerate or abnormal form of the Persian lilac (McKelvey, 1928).

At the end of the 19th century, hybrids between *S. laciniata* and *S. vulgaris* were produced through artificial pollination by L. Henry and by E. Lemoine. The hybrids were similar to those obtained by Varin, but varied according to the variety of the *S. vulgaris* parent used in the cross. Mrs. McKelvey recognizes about a dozen forms of *S. chinensis.* Several varie-

ties have originated as bud sports. These hybrids are generally considered to be the most attractive of all lilacs. They tend to resemble the Persian lilac in habit of growth and inflorescence, but the leaves usually are entire, as in the *S. vulgaris* parent. The Chinese lilacs are sterile and there is no conclusive evidence that they have ever produced viable seeds either spontaneously or as the result of artificial pollination.

The subgenus *Ligustrina* of *Syringa* includes three species, all of Asiatic origin. Little is known of their genetic relationships, as they are not of great horticultural interest. We have tried to obtain hybrids between these tree lilacs and species of the *Villosae* and *Vulgares* groups, but with no success.

In view of the remarkable correlation between the taxonomic classification and the genetic compatibility of the species of *Syringa,* the former taxonomic status of the Persian lilac was an enigma. The typical form of *S. persica* is a plant with predominantly entire leaves and resembles × *S. chinensis*, a known hybrid between *S. laciniata* and *S. vulgaris*. It is highly or completely sterile, although L. Henry in 1897 tells of crossing *S. vulgaris* with an entire-leaved Persian lilac and obtaining several dozen seedlings. There is, however, no record of seed production on any of the entire-leaved forms of *S. persica*. The typical form is not a native of Persia, nor has it been found wild in any part of the world. Mrs. McKelvey has shown that it was first recorded in 1660, fifty years after *S. laciniata* was described by a French naturalist, who obtained the variety from Italy as *Ligustrum nigrum.*

In 1900 E. Lemoine suggested that *S. persica* was a hybrid between *S. persica laciniata* and *S. vulgaris*. There is, however, no record of *S. vulgaris* in Persia, either as an indigenous or as an introduced plant, at the time of the origin of *S. persica*. It is possible that the obscure species *S. afghanica* was the entire-leaved parent. There is no doubt that *S. laciniata* was the other parent, because it was the only available species which could have contributed the genes for the occasional cut and laciniate leaves of *S. persica*. Cytological studies by Tischler (1930) and by the author (Sax, 1930) have shown that the meiotic divisions in *S. persica* are very irregular. The evidence from distribution, genetic behavior, and cytological analysis confirms Lemoine's conclusion that the typical *S. persica* is a hybrid and is allied to × *S. chinensis.*

Syringa laciniata is the only Persian lilac known to exist as an indigenous species. It was collected by F. N. Meyer in 1915 in Kansu, China. Seeds sent to the Arnold Arboretum produced plants which, according to Mrs. McKelvey (1928), were identical with the cut-leaved variety long known in cultivation as *S. persica laciniata*. It is evident that the cut-leaved variety is the only true species of Persian lilac and that it is a native not of Persia, but of China. Presumably it was introduced into Persia over the old trade routes from China long before the 17th century.

The entire-leaved Persian lilacs and all varieties of *S. chinensis* grown in the Arnold Arboretum are sterile. Occasionally *S. chinensis* sets a few

partially developed seeds, but none have been viable. We have had no success in crossing these species with either *S. vulgaris* or *S. laciniata*. Earlier cytological studies (Sax, 1930) showed great cytological irregularity at meiosis with about 12 bivalents and 12 univalents. Since all pure species of *Syringa* have 22–24 pairs of chromosomes, the apparent cytological behavior of the hybrids was difficult to explain. More recent studies show that the normal chromosome number is present at diakinesis, but the pairing is loose and irregular.

Our crosses between *S. laciniata* and *S. vulgaris* have set seeds and most of the seedlings have lived for one or two years, but we have obtained no mature plants. In 1939 and in 1940 open pollinated seeds were collected from the only remaining specimen of *S. laciniata* in our collections. A total of 243 plants was grown. Of these only six had the cut leaves characteristic of the seed parent. These seedlings during the first few years were entirely cut-leaved and the leaves were more pinnate than those of the mature seed parent. In fact, these plants appeared to be a new and distinct type of lilac. In the fifth year, however, these segregates lost their juvenile characters and began to resemble the mature maternal parent, and were very similar to four-year-old cuttings from the parent plant. The transition from the juvenile form to the mature plant is shown in *Figure 1*. These seedlings are fertile and are undoubtedly the result of self-pollination which reproduces the parental species.

The remaining 237 seedlings all were predominantly entire-leaved as they developed. Most of these plants survived for only one or two years and only five have survived to 1944. Two of the survivors have flowered but have set no seeds. In every respect they resemble *S. chinensis* and certain forms of *S. persica* except that they are less vigorous. The leaf types of the two parents and of a form of *S. chinensis* are shown in *Figure 2*. The entire-leaved seedlings must be spontaneous hybrids between *S. laciniata* and the surrounding specimens of *S. vulgaris*. The fact that most of the seedlings were weak and did not survive apparently is not unusual in this and other species hybrids of *Syringa*. Although Varin is reported to have planted open pollinated seeds of *S. persica laciniata* for many years and no doubt Lemoine made many artificial crosses, yet we have only about a dozen varieties of the hybrids. Since there are hundreds of varieties of *S. vulgaris*, an equal number of *S. chinensis* hybrids could be obtained if the cross were fully compatible. Apparently *S. laciniata* is highly, but not completely, self-sterile. It sets a few selfed seeds, but is usually cross-pollinated, and will cross spontaneously with adjacent specimens of *S. vulgaris*. Most of the resulting seeds are viable, but only a few develop into vigorous mature plants.

Syringa chinensis and *S. persica* have predominantly entire leaves, but all forms have some lobed or laciniate leaves. The prevalence of entire leaves varies in different varieties of the hybrids. The frequence of cut leaves appears to depend upon the vigor of the plant, and different branches of the same plant may vary greatly in leaf form. The leaf types

of mature hybrids are shown in *Figure 3*. These specimens are from different plants, but similar variation often can be found on the same plant.

Further evidence of the genetic nature of *S. laciniata* is provided by the results of crossing with *S. pinnatifolia*. The F_1 seedlings are vigorous and uniform. The leaves of the parents and the hybrid are shown in *Figure 4*. The twigs of the parent species are from mature plants, while that of the F_1 is from a two-year-old seedling. As the hybrid matures the leaf characters may become more intermediate. The uniformity of the eight F_1 plants indicates that both parents are relatively homozygous. *Syringa pinnatifolia* is highly self-sterile and sets seed only when pollinated by adjacent *S. oblata* (Rehder, 1935) or perhaps *S. vulgaris* plants. The natural hybrids are relatively uniform and are sterile, but are of little horticultural value. The *S. laciniata* × *S. pinnatifolia* hybrids are attractive shrubs and should be of considerable horticultural value if the flowers prove to be at all attractive.

SUMMARY

There is a remarkable correlation between the taxonomic classification of the genus *Syringa* and the genetic compatibility of the 28 species. With one exception the species which belong to different subgenera and series have not been crossed spontaneously or by artificial pollination. Species within these taxonomic units show considerable genetic compatibility, although many of the hybrids often lack vigor and most of them are sterile. *Syringa pinnatifolia*, the sole species of the *Pinnatifoliae* series, can be crossed with *S. oblata* and *S. laciniata* of the *Vulgares* series, but is placed in a distinct series on morphological grounds.

The species hybrids of greatest horticultural value have been obtained from crosses between *S. laciniata* and *S. vulgaris* and are known as × *S. chinensis*. The entire-leaved Persian lilacs also are hybrids involving *S. laciniata* and an entire-leaved species — *S. afghanica* or *S. vulgaris*.

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EXPLANATION OF PLATE I

FIG. 1. Variation in foliage of *S. laciniata*. Juvenile stage at left from a four-year-old seedling. Transitional stage in center from five-year-old seedling. At the right are three specimens from the same mature plant. FIG. 2. Foliage of *S. laciniata* and *S. vulgaris*, with the hybrid *S. chinensis* between. FIG. 3. Variation in foliage of *S. persica*. These specimens were from different varieties, but similar variation often can be found on a single plant. FIG. 4. Foliage of *S. laciniata* (left) and *S. pinnatifolia* (right), and of the F_1 hybrid seedling.

ARNOLD ARBORETUM,
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Lilac Species Hybrids

ON THE UNDERGROUND PARTS OF TACCA PINNATIFIDA J. R. & G. FORST. (1776) = TACCA LEONTOPETALOIDES (LINN.) O. KUNTZE

E. D. MERRILL

With two plates

WHEN I undertook the preparation of the illustrations for Technical Manual 10–420[1] in the fall of 1942, naturally one of the species that I wished to include was the plant currently known as *Tacca pinnatifida* J. R. & G. Forst., the so-called Polynesian arrow-root. This is essentially a strand species in certain parts of the Old World tropics, and in former years it was an important source of food for the various native peoples inhabiting the vast area covered by its range. In earlier years it was actually cultivated by various peoples and in various localities all the way from India to Hawaii as well as in central Africa; as noted below, its present-day range in the Pacific region may be largely or perhaps wholly due to its ancient cultivation there. In modern times its actual cultivation has largely ceased. Its fairly large tubers are intensely bitter and are reported to be poisonous if eaten; yet the starch is easily extracted by maceration and washing, and, as finally prepared, it was utilized as food.

I turned to the published literature with confidence that I could locate a good illustration of its underground parts, for in excess of 25 pictures exist in botanical and horticultural literature. In this search I was disappointed. Being personally familiar with the plant, having seen it some thirty years ago as it occurs in nature, I knew what to expect, and yet when it came to preparing an illustration I did not dare to depend on my memory after the lapse of so many years. As a result, the drawing I had prepared for the Technical Manual depicts only those parts of the plant above the surface of the ground. Apparently in my years of tropical service I assumed, as others had done, that everything worthy of note regarding the underground parts of this striking species had been recorded in botanical literature, for many scores of descriptions have been published, to say nothing of the numerous illustrations. In all the literature examined I have found only two good descriptions of the underground parts, those of Rumphius in 1747 and Degener in 1932, but no really good illustrations.

It is indeed curious that good illustrations of the underground parts of this species apparently do not exist. In earlier years, in addition to its extensive cultivation here and there in the Old World tropics and the com-

[1] MERRILL, E. D. Emergency food plants and poisonous plants of the Islands of the Pacific. War Department, Technical Manual 10–420: 1–149. *f. 1–113.* 1943. Government Printing Office, Washington. Available from the Superintendent of Documents, price 15 cents.

mon utilization of its starch as food, it was commercially exploited in Polynesia, for the prepared starch, known as Tahiti arrow-root and as Polynesian arrow-root, was exported to Europe. In the middle of the last century large shipments are reported to have been made from Honolulu to San Francisco, particularly at the time of the gold rush to California in 1849–50.

In the special literature on economic plants there are numerous references to the actual cultivation of this *Tacca,* but today it apparently receives little attention. Dr. Harold St. John, of the University of Hawaii, informs me that it was formerly extensively cultivated in Hawaii, and that it was an important food plant. Some plantings were carefully attended, but in other places it was allowed to grow unattended in brush-lands adjacent to cultivated tracts. He notes that it is still cultivated by a few natives in the Kona District on the Island of Hawaii, but that its tubers are no longer shipped to Honolulu; further, that it also persists near the sites of former Hawaiian habitations on all the larger islands of the group. Being familiar with the plant as it occurs not only in Hawaii but also on Mehetia, Mangareva, Pitcairn, Rapa, Rurutu, Rotuma, and in Fiji, he is of the opinion that its occurrence and distribution in Polynesia are due to its tubers having been carried from one island to another by the early Polynesians, and he even suggests that it is a crop plant unknown in the wild.

This may be true for the Pacific islands, but it does not apply to those parts of Malaysia with which I am familiar. I believe that in the Malay Archipelago it is a native littoral species, and further, that its present-day distribution in Malaysia is probably due to its buoyant seeds having been floated here and there by ocean currents, assuming of course that they may retain their viability for some time while floating in salt-water. I base this belief on Guppy's observations as well as my own.

This belief is confirmed by the observations of Ridley,[2] who states, p. 318, that the plant grows in sand on the seashore and that its seeds have a spongy testa, by means of which they float for many months. He accounts for its wide distribution in central Africa (and this would apply to its occurrence in cultivation in parts of India) and perhaps to some extent for its abundance in the Polynesian islands by the utilization of its tubers as food, with the significant statement that: "In the intermediate area [i. e., Malaysia] it is rarely if ever used for food, and is not planted." Yet Rumphius notes the use of its starch for food in Amboina at the end of the sixteenth century, and Blanco, in 1837, states that the starch, known as *gaogao,* was sold in the Manila markets. Thus it may well have been cultivated here and there in the Malay Archipelago in earlier times.

In the Philippines one occasionally notes scattered plants in inland localities, but in such places the species is rare. However, on various small, isolated, and uninhabited islands — and such islands where I observed it are quite incapable of supporting human life, being unadapted to agricul-

[2] Ridley, H. N. Dispersal of plants throughout the world. i–xx. 1–744. *t. 1–22.* 1930.

tural pursuits — one frequently finds the species in abundance. On such islands it is found immediately back of the seashore, in deep sand heavily charged with comminuted vegetable debris, well above high-tide mark, in the partial shade of beach thickets and forests, but yet where the sand is at times disturbed by wave action. This observation as to its natural habitat being near the seashore conforms with those of others, notably Rumphius, who for this particular species selected the name *litorea* because of its characteristic habitat. On such islands as above noted I never observed it inland from the seashore. Guppy,[3] in contrasting *Tacca pinnatifida* with another species, states that the seeds of *Tacca pinnatifida* float for months, and that they owe their buoyancy to the spongy tissue developed in their seed-coverings. Unfortunately, he did not determine how long the seeds floating in salt-water retained their viability; this, as with the seeds of such species as *Hibiscus tiliaceus* Linn. and other widespread strand plants, would seem to be a desirability.

Here is apparently a species native of certain littoral parts of the Malay Archipelago and distributed through natural means throughout that region and perhaps to littoral regions of southern Asia, but which has further been distributed by man in various parts of India, especially inland, and to the wide stretches of the Pacific Ocean. However, the objective of this short paper is to discuss the underground parts of the plant, rather than its origin and how it was distributed. Whatever the method or methods of distribution, its present range extends from India and Ceylon to Indo-China and Formosa, southward through Malaysia to the northern parts of Australia and New Caledonia, and throughout the Pacific region as far east as Hawaii and the Marquesas Islands. It is suspected that the African material referred by Limpricht to another species actually represents the one here discussed.

In checking the numerous listed illustrations, I note that the first published one, that of Ammann in 1741, does show two tubers, but here possibly because the artist may have superimposed the basal parts of two plants, one in flower and one in fruit (*Plate 2, f. A*). This first published picture of the underground parts is the best one yet issued in that possibly it does depict the original tuber and the new primary tuber terminating a short rhizome.

In the horticultural literature, generally speaking, only those parts of the plant above ground are shown, the various authors who published colored plates prepared from living specimens apparently having been interested only in the ornamental aspects of the plant. A few botanical illustrations do show the beginning of the development of the specialized tuber-bearing rhizomes. Curiously, several of the modern illustrations go back to Rumphius (1747), sometimes as to the habit, more frequently as to the underground parts, which are not too well depicted, although excellently

[3] Guppy, H. B. Observations of a naturalist in the Pacific between 1896 and 1899, **2: 19.** 1906. (Plant dispersal).

described by him. In the recent standard monographic treatment[4] of 1928, the only illustration of this very common and widely distributed species was taken wholly from Rumphius. This is *Tacca litorea* Rumph. Herb. Amb. 5: 328. *t. 114.* 1747. The illustration was prepared about 1690, although not published until 1747; this figure shows only a somewhat deformed and shrunken old tuber (*Plate 1, f. A*) from which the plant had developed, but neither the characteristic rhizomes nor the equally characteristic new tubers that are produced at the ends of the rhizomes and at some distance from the base of the plant. Lamarck's misleading illustration of 1793 was clearly drawn from an herbarium specimen (*Plate 1, f. B*) and is very unsatisfactory. Dubard, Agr. Prat. Pays Chauds 11: 106. *f. 38.* 1911 (*Plate 1, f. E*), illustrates the vegetative parts as springing from a depressed-globose tuber which bears a couple of incipient rhizomes but no secondary tubers. Sadebeck, Die Kulturgewächse der deutschen Kolonien und ihre Erzeugnisse, *f. 31.* 1899, depicts the initial tuber but without rhizomes or secondary tubers (*Plate 1, f. C*). Degener, Fl. Hawaiiensis 2: *t.* [*11*]. 1932, while giving one of the best descriptions of the underground parts that I have seen (*Tacca hawaiiensis* Limpr. = *T. pinnatifida* J. R. & G. Forst. = *T. Leontopetaloides* (Linn.) O. Kuntze), provides an excellent habit sketch of the plant but without even a vestige of the old tuber, although his illustration does depict a couple of incipient rhizomes (*Plate 1, f. D*). His description of the underground parts is so good that it is here reproduced:

"Glabrous herb with depressed-globose light yellowish brown about 5 cm. high and 8 cm. wide thin-skinned smooth tuber near surface of ground . . . which is replaced during the year by a new main tuber which arises from a downward-growing thick rhizome at a lower level and remains dormant after yearly death of aerial parts of plant; secondary smaller tubers also forming from buds above old tuber and spreading downward; tubers white within, starchy, somewhat juicy; roots arising from top of old tuber, spreading. . . ."

But this is not the only good published description, for that of Rumphius, written toward the close of the seventeenth century but not published until 1747, is actually as good. The Latin version of this old description is: "Radices ejus panem referunt, magnitudine binorum pugnorum, immo majores, nudae & gilva obductae pellicula, interne albae, & succosae, atque ex superiore ipsarum parte multae dependent fibrillae, undique autem ad latera modi excrescunt, ex quibus novi propullulant surculi. Primaria vero radix directe cauli obposita saepe haud major est minore pugno, bulbosa, ac sine gemmis, ad binorum vero digitorum spatium supra hanc e stipite crassus excrescit caulis, deorsum flexus, e quo similis dependet radix, seu bulbus, plerumque major primaria radice." His original Dutch version is equally good and explicit: "De worteln zyn broodjes in de groote van twee vuisten of meer, buiten kaal, en met een vaal buideken omgeven, binnen wit, en zappig, van boven hangen 'er veele Vaselingen, rondom ter

[4] LIMPRICHT, W. Taccaceae. Pflanzenreich 92(IV. 42): 1–32. *f. 1–5.* 1928.

zyden komen knobbeln voort, waar uit nieuwe spruitjes worden. De principaale wortel regt over den stam staande is dikwils niet grooter dan een kleene vuist, bultig, en zonder afzetzel, maar twee vingers boven de zelve komt uit den stam een dikken steel neerwaarts, daar aan een diergelyke wortel of bol hangt, gemeenlyk grooter dan de principaale."

Clearly Rumphius excavated the underground parts carefully, noting the characteristic downward-growing rhizomes produced from the stem just above the old tuber, that a new tuber was formed at the end of each rhizome, and further that the new main tuber was larger than the original one. I have reproduced these two old descriptions in extenso, for they conform to Degener's modern one quoted above. That Rumphius did not depict the underground parts as he described them should not be charged against him, when it is understood that his original illustrations were destroyed by fire, and that the new ones that were used to illustrate his Herbarium Amboinense were prepared by others after he had become blind. Clearly what one observes regarding the underground parts of this very characteristic and striking species depends on how carefully the tubers are dug and at what stage in the development of the plant the excavating was done. One might find, shortly after the vegetative parts appear, only a normal tuber; later this tuber would be more or less deformed and shrunken; still later the new rhizomes would be evident; and finally, if the underground parts be examined after the vegetative parts have reached full maturity or have disappeared, the original tuber would be found to have been more or less absorbed, and the new main tuber even larger than the original one, with a varying number, never very numerous, of smaller tubers which at the next growing season would produce small plants; these new tubers, large and small, are solitary and each terminates a simple rhizome.

Tubers that I examined many years ago in the Philippines varied from about five to about seven or eight centimeters in greatest diameter, varying in shape from globose to broadly ellipsoid. The new ones occurred in the loose sandy soil some distance from the base of the old plant and sometimes as much as ten inches below the surface of the soil. Dubard, l. c., notes that, according to the soil conditions, the new tubers may be as much as a foot from the base of the plant. Wohltmann[5] reproduced a photograph of somewhat dessicated tubers originating in Samoa, the largest being about 10 cm. in diameter, stating: "Das unterirdische, bisweilen kriechende Rhizom entwickelt Achselsprosse, welche sich zu mit dichtem Stärkemehl angefüllten Knollen verdicken." Mr. W. Greenwood, of Lautoka, Fiji, who kindly sent me some dried material, states that the tubers in Fiji are about five by seven centimeters as he has observed them; two of these small tubers from a very young plant are shown (*Plate 1, f. I, K*). The plants, being juvenile, were not more than about a foot high, and the characteristic rhizomes and secondary tubers had not commenced to form except in one case, among the several examined. I am also indebted to Mr. E. Y.

[5] Wohltmann, F. Tacca pinnatifida, die stärkemehlreichste Knollenfrucht der Erde. Tropenpflanz. 9: 120–128. *f. 103.* 1905.

tion many collectors in the field give to the underground parts of plants that they collect. The situation a few centuries ago is in sharp contrast to this, for then, because of the medicinal or other economic uses of the underground parts of plants, those concerned with preparing illustrations of plants generally gave very special attention to roots, tubers, bulbs, rhizomes, and corms, that are normally not shown at all well by ordinary herbarium specimens.

EXPLANATION OF PLATES

PLATE I

Underground parts of *Tacca Leontopetaloides* (Linn.) O. Kuntze (*T. pinnatifida* J. R. & G. Forst.). FIG. A. The tuber after Rumphius (1747). FIG. B. The tuber after Lamarck (1793). FIG. C. The tuber as depicted by Sadebeck (1899). FIG. D. No old tuber shown but incipient rhizomes are indicated, Degener (1932). FIG. E. The initial tuber and two incipient rhizomes as depicted by Dubard (1911). FIGS. F, G, H, J. Redrawn from sketches made by Miss Marie Neal, Bishop Museum, Honolulu, all from preserved material except F, which was taken from a herbarium specimen; of these G depicts the remnants of the initial tuber and two rhizomes, one of these bearing a partly grown secondary tuber, and H, a mature tuber as detached from the end of a rhizome. FIGS. I, K. Young tubers from juvenile Fijian plants, one showing the beginning of a rhizome, the last two natural size.

PLATE II

FIGS. A, B. The original illustrations of *Leontopetaloides,* Amman[n] Comment. Acad. Sci. Petrop. 8: *t. 13.* 1741. This is the entire basis of *Leontice Leontopetaloides* Linn. Sp. Pl. 313. 1753, and hence of *Tacca Leontopetaloides* (Linn.) O. Kuntze. Both Linnaeus and Limpricht cite the plate as *113.* There are two plates, both indicated as "Tab. XIII," the first showing the habit of the entire plant, including the underground parts, the second a part of a leaf, the inflorescence, fruits and flowers, and the tuber (detached), natural size. Incidentally the underground parts are depicted on the plate showing the habit of the entire plant more nearly as they actually are than in any hitherto published illustrations that I have seen. Reduced about ½.

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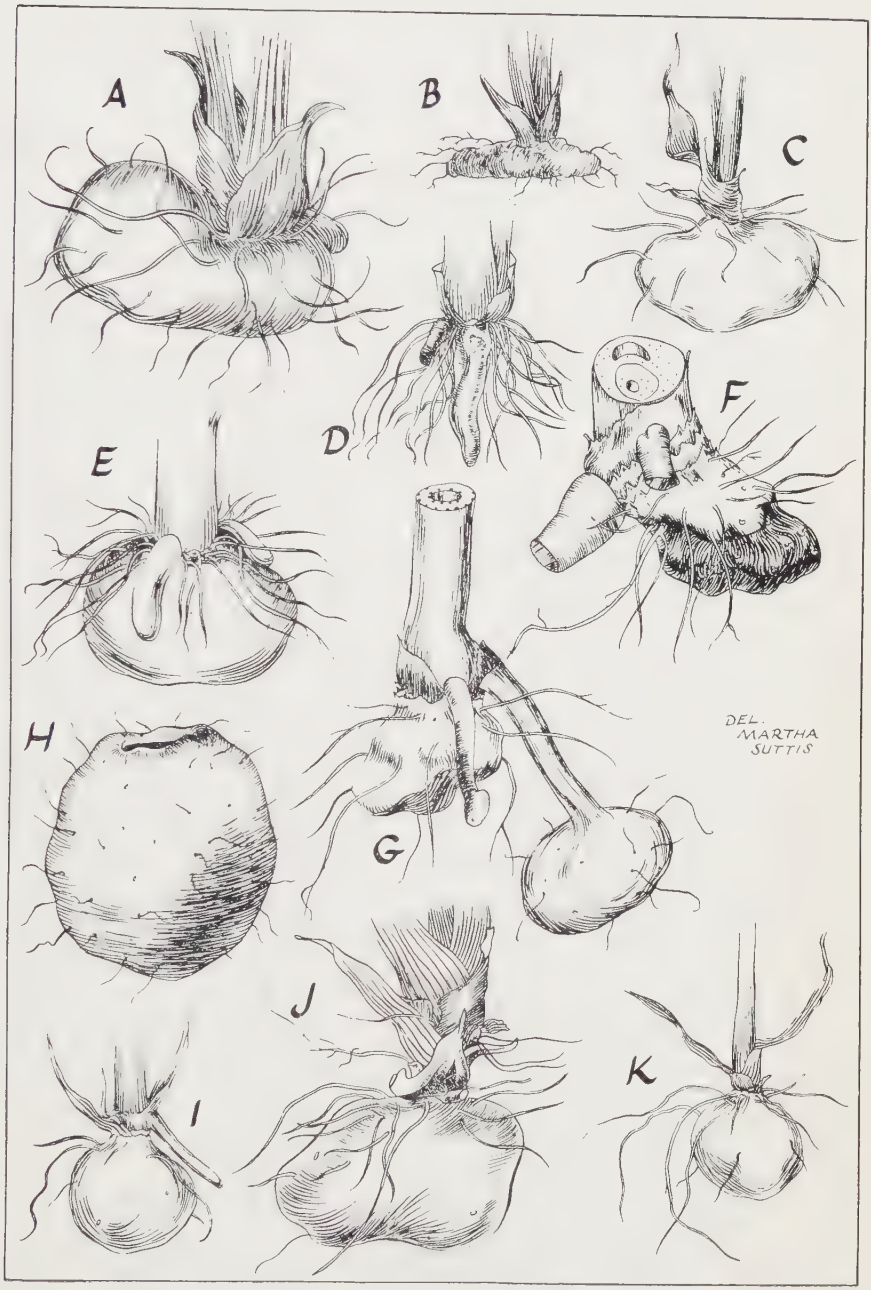
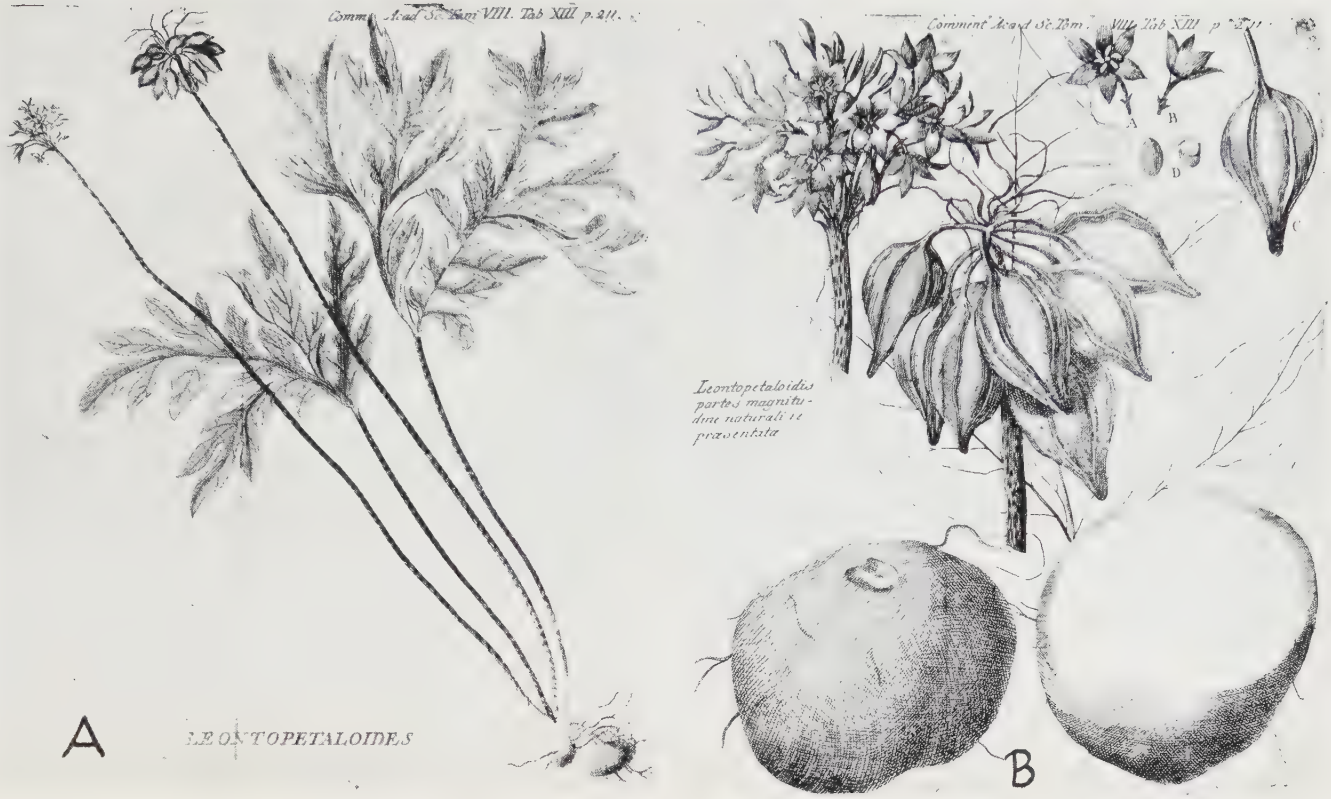


Tacca Leontopetaloides (Linn.) O. Kuntze



Tacca Leontopetaloides. (Linn.) O. Kuntze

OCHROCARPOS ODORATUS (RAFINESQUE) MERRILL, A NEW NAME FOR A MUCH NAMED SPECIES, WITH A NEW SPECIES FROM SAMOA

E. D. Merrill

With one text-figure

A change in the name of the widely distributed Old World strand tree currently known as *Ochrocarpus*[1] *excelsus* Vesque and as *O. ovalifolius* T. Anders. is inevitable under the provisions of the International Code of Botanical Nomenclature. The genus *Lolanara* Raf. (1837) was based wholly on "*Lolanwara*" [i.e., *Lolan waran, Lignum clavorum* Rumph. Herb. Amb. 3: 97. *t. 64.* 1743], as was its sole species *Lolanara odorata* Raf. Rafinesque's original rather sketchy description is as follows: "*Lolanara* R (nom ind) Cal. bisquamosus, Petalis 6, duplice series, 3 int. major. Stam. plurima hypogyna. Drupo ovato, nucleo bivalvis intus pulposo polysp.? — *L. odorata* fol. ovatis sparsis scabris. Oceanic tree. Lolanwara of Rumphius. Family Hesperidia." — Raf. Fl. Tellur. 2: 34. 1836 [1837]. This generic name first appears as a *nomen nudum,* Raf. op. cit. 1: 16. 1836 [1837].

Lolanara Raf. and *L. odorata* Raf. were duly entered in Index Kewensis 2: 108. 1894. the position of the genus being indicated as: "An SAPOTACEA? — Cf. Hassk. Neuer Schl. zu Rumph's Herb. Amboin. 55." The generic name is not listed by de Dalla Torre and Harms, Genera Siphonogamarum. When I was attempting to determine the status of the various forms described by Rumphius in his monumental Herbarium Amboinense[2] and the numerous binomials based by later authors on that work, naturally handicapped by the limited library facilities available in Manila, where the task was accomplished, I did not have access to Rafinesque's work and overlooked the entry in Index Kewensis. Heyne's[3] disposition of *Lignum clavorum* Rumph., the key to the proper reduction of *Lolanwara odorata* Raf., appeared in the same year that my work was published, he referring the plant that Rumphius described and illustrated to *Ochrocarpus ovalifolius* T. Anders., but it should be noted that Pierre had reduced *Lignum clavorum* Rumph. to *Calysaccion excelsum* Pierre as early as 1896, Bull. Soc. Linn. Paris 2: 1225. 1896. As no botanical material from Amboina or its neighboring islands representing *Lignum clavorum* Rumph. was available to me, I could only accept Teysmann's suggestion, as listed by Hass-

[1] The original spelling of the generic name was *Ochrocarpos,* which I have retained. Most authors have used the form *Ochrocarpus.*

[2] Merrill, E. D. An interpretation of Rumphius's Herbarium Amboinense. 1–595. 1917.

[3] Heyne, K. De nuttige planten van Nederlandsch-Indië 3: 257. 1917.

karl, that some genus of the Sapotaceae was represented; although here it should have been evident that some other family was represented from the Rumphian description if not from the illustration. Earlier, Henschel had referred the Rumphian entity, with doubt, to *Calophyllum spurium* Choisy, the family being correct, but the genus manifestly wrong. See also Lam, Bull. Jard. Buitenzorg III. 7: 247. 1925. Thus to the synonymy of *Ochrocarpos* Thouars (1808) (*Calysaccion* Wight, 1840), *Lolanara* Raf. (1837) is to be added. The synonymy of this much named species is as follows:

Ochrocarpos odoratus (Raf.) comb. nov.

Lolanara odorata Raf. Fl. Tellur. 2: 34. 1836 [1837].

Calophyllum excelsum Zoll. & Mor. Nat. Geneesk. Arch. Ind. 2: 582. 1845; Hassk. & Zoll. Flora 30: 661. 1847.

Calysaccion ovalifolium Choisy, Mém. Soc. Phys. Hist. Nat. Genève 12: 425. 1850 (Guttif. Ind. 45).

Mammea excelsa Planch. & Triana, Ann. Sci. Nat. IV. Bot. 15: 244. 1861.

Calysaccion obovale Miq. Fl. Ind. Bat. Suppl. 500. 1862; A. Gray, Proc. Am. Acad. Arts Sci. 5: 315. 1862.

Calysaccion tinctorium Seem. Fl. Vit. 13. *t. 9*. 1865.

?*Calysaccion Horstii* Teysm. & Binn. Cat. Hort. Bogor. 205. 1866, *nom. nud.*

Ochrocarpus ovalifolius T. Anders. ex Hemsl. Bot. Challenger Exped. 1(2): 122, 234. 1885; Guppy, Solomon Islands 294. 1887; K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 449. 1901; Koord. & Val. Bijdr. Boomsoort. Java 9: 391. 1903; Baker f. Jour. Bot. 61: Suppl. 9. 1923.

Ochrocarpus pachyphyllus K. Schum. in K. Schum. & Hollr. Fl. Kaiser Wilhelms Land 51. 1889; K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 449. 1901.

Ochrocarpus tinctorius Drake, Ill. Fl. Ins. Mar. Pacif. 116. 1890; Lauterb. Bot. Jahrb. 41: 231. 1908.

Ochrocarpus excelsus Vesque in DC. Monog. Phan. 8: 525. 1893; Merr. Philip. Jour. Sci. 9: Bot. 115. 1914, 29: 398. 1926; Lauterb. Bot. Jahrb. 58: 6. *f. 1, A-H*. 1922, 59: 19. 1924; Kanehira, Bot. Mag. Tokyò 45: 330. 1931, Fl. Micrones. 240. *f. 111*. 1933, Jour. Dept. Agr. Kyushu Univ. 4: 372. 1935; Hosokawa, Bull. Biogeogr. Soc. Japan 5: 145. 1934, 7: 196. 1937; Christoph. Bishop Mus. Bull. 128: 147. 1935.

Calysaccion excelsum Pierre, Bull. Soc. Linn. Paris 2: 1225. 1896.

Ochrocarpos obovalis Safford, Contr. U. S. Nat. Herb. 9: 335. 1905.

Lignum clavorum Rumph. Herb. Amb. 3: 97. *t. 64*. 1743.

The species is a very widely distributed one in Malaysia, Micronesia, and western Polynesia, having been recorded by various authors, under various names, from Java, Sangian (Sunda Strait), Christmas Island (south of Java), Borneo, Banguey, the Moluccas, Timor, Kei Archipelago, Admiralty Islands, New Guinea, Bismarck Archipelago, Solomon Islands, Marianas, Caroline and Palau Islands (Guam, Saipan, Tinian, Rota, Pagan, Truk, Palau, Kusai, Ponape), Fiji, and Samoa. All authors are in agreement that it is a littoral tree, and doubtless it is to be classed among those species whose fruits or seeds are adapted to dissemination by floating in salt water. I have examined the following specimens:

PHILIPPINES: Mangsi Island, between Balabac and Borneo, *Wilkes Expedition* (G), originally identified as representing *Garcinia mangostana* Linn. and later corrected to *Calysaccion obovale* Miq.; this is a record new to the Philippine flora. BORNEO: Banguey Island, *Castro & Melegrito 1412*. JAVA: Pandeglang, *Netherl. Ind. For. Serv. Ja. 2625*. MOLUCCAS: Wetar and Boeroe Islands, *Netherl. Ind. For. Serv. bb.*

27281, 22702. SOLOMON ISLANDS: Owa Raha Island, *L. J. Brass 2081.* MARIANAS ISLANDS: Guam, *Guerrero 755;* Tinian, *Kanehira 1066.* CAROLINE ISLANDS: Palau, Babeldaob, *Kanehira 5040.* FIJI: *Seemann 46* (G) (isotype of *Calysaccion tinctorium* Seem.), *A. C. Smith 1190* (G).

Various recorded VERNACULAR NAMES are *chopak* (Tinian), *chopag* (Guam), *fetau* (Samoa), *kapurantia* (Amboina), *kembang satoe* (Java), *loro waran, lolan waran, lolan wakan* (Amboina), *luas* (Truk), *lues* (Ponape), *ogoldveesak* (Palau), *oyag* (Fiji), *oyagu* (Truk), *manapau* (Samoa), *tatarat* (Bismarck Archipelago), *lalan bitauer, mattabue, mattabuen* (Buru), *vetao, uvitao* (Fiji).

Thus a rather formidable synonymy has been built up over the course of years, in part due to the fact that botanists working in different centers did not have access to material in other institutions, and were thus obliged to depend on not always too satisfactory descriptions, and in part, doubtless, due also to frank differences of opinion as to the limits of this or that pro-

FIG. 1. *Ochrocarpos glaucus* Merr.: a fruiting branchlet drawn from the type, × about ⅔.

posed species. The species is remarkably uniform in its various characters throughout its wide range.

Ochrocarpos glaucus sp. nov. FIG. 1.

Arbor 15–18 m. alta, glaberrima (floribus ignotis), ramis ramulisque pallidis plus minusve longitudinaliter rugosis, ultimis 1.5 mm. diametro; foliis crasse coriaceis, oblongo-ellipticis, 6–10 cm. longis, 3–4 cm. latis, obtusis vel rotundatis, basi subrotundatis vel late acutis, supra pallide olivaceis, nitidis, subtus glaucis, nervis primariis utrinsecus 7–10, subtus paullo elevatis, haud perspicuis, arcuato-anastomosantibus, utrinque sub-

dense reticulatis, costa subtus elevata, crassa; petiolo 1 cm. longo; floribus ignotis; fructibus solitariis, in axillis defoliatis, immaturis inaequilateraliter anguste ovoideis, sursum plus minusve angustatis, crasse subrostratis, in sicco castaneis, sublaevibus, 2 cm. longis et 1 cm. diametro; sepalis caducis.

SAMOA: Savaii, above Matavanu, *Christophersen & Hume 2029,* July 15, 1931, in medium wet forest, alt. about 900 m., a tree 15–18 m. high, fruits green. Type, herb. Arnold Arboretum.

Although the flowers of this species are unknown and the fruits are immature, it clearly represents an undescribed species of *Ochrocarpos,* characterized by its small leaves which are distinctly glaucous beneath. It, with *Christophersen & Hume 2053,* from the same locality, is mentioned by Christophersen in a note following *Ochrocarpus excelsus* Vesque, Bishop Mus. Bull. 128: 147. 1935, as possibly representing an undescribed species.

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STUDIES OF PACIFIC ISLAND PLANTS, IV
NOTES ON FIJIAN FLOWERING PLANTS

A. C. Smith

In the present paper a discussion of several species in various families is presented and five species, based for the most part on recently collected material, are described as new. I am indebted to Dr. L. Croizat for the descriptions of two new species of Euphorbiaceae, here included. Herbaria in which cited specimens are deposited are indicated by parenthetical abbreviations: Arnold Arboretum (A), Bernice P. Bishop Museum (Bish), Gray Herbarium (GH), New York Botanical Garden (NY).

POTAMOGETONACEAE

Diplanthera uninervis (Forsk.) Aschers. in E. & P. Nat. Pfl. Nachtr. 1: 37. 1879; F. N. Will. in Bull. Herb. Boiss. II. 4: 221. 1904; Aschers. & Graebn. in Pflanzenr. 31 (IV. 11): 152. 1907; Greenwood in Jour. Arnold Arb. 25: 402. 1944.

Viti Levu: Nandronga: Thuvu, *Greenwood 927* (GH) (in sand above and below low water mark on shores; broken pieces cast up in large quantities), *Greenwood 927B* (GH) (on beach); Serua: Naitonitoni Beach, near Navua River, *Greenwood 927A* (GH).

The recent Fijian collections of this widespread species are of interest because of the paucity of Pacific specimens in herbaria. The species has previously been reported from Fiji, usually as *Halodule australis* Miq., but a definite collection has been cited only by Greenwood (l. c.). The plant is not accounted for in Seemann's Flora Vitiensis.

HYDROCHARITACEAE

Hydrilla verticillata (L. f.) Royle, Ill. Bot. Himal. 376. 1839; Presl, Bot. Bemerk. 112. 1844 [adv. repr. from Böhm. Ges. Wiss. Abh. V. 3: 542. 1845]; Caspary in Bot. Zeit. 14: 901. 1856; Benth. Fl. Austral. 6: 259. 1873; Aschers. & Gürke in E. & P. Nat. Pfl. II. 1: 250. *f. 184, A, B.* 1889; Gagnep. in Lecomte, Fl. Gén. Indo-Chine 6: 4. *f. 2.* 1908; Koorders, Exkursionsfl. Java 1: 94. 1911, Atlas 1: *f. 21.* 1913; F. M. Bailey, Compr. Cat. Queensl. Pl. 518. 1913; Greenwood in Jour. Arnold Arb. 25: 403. 1944.

Serpicula verticillata L. f. Suppl. 416. 1781; Roxb. Pl. Coast Corom. 2: *pl. 164.* 1798.

Viti Levu: Nandi: Tuna River, *G. Dennis 955* (GH) (forming extensive mats in tidal waters in the dry season, but washed out in large quantities during heavy rains in the wet season; in flower Nov. 10, 1942).

The cited specimen must be considered one of the most interesting recently obtained in Fiji, as it extends the range of *Hydrilla* into the Pacific area. From records which I can locate, the nearest stations are in the East Indies and Australia, the species apparently not having been noted from either New Guinea or New Zealand. Our specimens bear young staminate flowers, which are still in the membranaceous muricate spathes. Mr. Greenwood (in litt.) expresses the opinion that *Hydrilla* was probably introduced into Fiji.

EUPHORBIACEAE

By L. CROIZAT

Cleistanthus micranthus Croizat, sp. nov.

Arbuscula 5-metralis, innovationibus pilis perpaucis brevibus exceptis glabris subangulatis, ramis adultioribus dissite irregulariterque lenticellatis. Foliis distichis ellipticis plus minusve falcatis 7–9 cm. longis, 2–3 cm. latis, glaberrimis, subcoriaceis, pallide brunneo-olivaceis subconcoloribus, margine integerrimo subrevoluto, nervis late patentibus, margine anastomosatis, gracilibus, ca. 8-jugis, petiolo ruguloso vix 0.5 cm. longo, stipulis coriaceis late triangularibus integris ad 1 mm. longis et 1 mm. basi latis. Inflorescentiis more generis axillaribus pulviniformibus, vix 0.5 cm. latis et longis, plurifloris squamulosis glabris, secus ramulum dissitis. Flore ♂ anthesi vix ineunte viso: calyce glabro subgloboso ca. 1.2 mm. lato, laciniis triangularibus crassiusculis oblongo-deltoideis ca. 1.3 mm. longis, 0.7–0.8 mm. latis, petalis minutis albicantibus subdolabriformibus cuspidatis, ca. 0.5 mm. longis, 0.6–0.7 mm. latis, disco annulari-pulvinato integro ca. 0.25 mm. alto; staminibus pro ratione floris magnis, brevibus, oppositisepalis, antheris oblongis ca. 0.7 mm. longis et 0.6 mm. latis, apiculatis, basi divaricatim sagittatis, filamento crassiusculo ca. 0.5 mm. longo; pistillodio ovoideo ca. 0.8 mm. longo, apice 3-partito, laciniis aequalibus stylum cum stigmatibus simulantibus. Floris ♀ perianthio unico sub fructu viso, putrido, saltem annotino, ca. 3 mm. lato, breviter stipitato, columella ca. 3.5 mm. longa, basi florum ♂ hornotinorum glomerulis fulto.

VITI LEVU: Serua: In hills, alt. about 200 m., *Greenwood 1018* (A, TYPE), May, 1943 (tree 5 m. high).

This is the first record of *Cleistanthus* Hook. f. in the Fiji Islands. The genus has so far been known only from certain islands of Micronesia, such as the Pelew and Truk groups (*C. carolinensis* Jabl., *C. insularis* Kanehira, *C. angularis* Kanehira, *C. Morii* Kanehira), and New Caledonia (*C. stipitatus* Muell. Arg.), not to mention points farther west, from Australia to eastern Africa, which represents its probable center of dispersal. *Cleistanthus micranthus* is most nearly allied to *C. stipitatus* Muell. Arg., but differs in the spreading primaries, the less coriaceous and blunter leaf, and the smaller, glabrous inflorescence. In the classification of Jablonszky (in Pflanzenr. 65[IV. 147. VIII]: 35. 1915), *C. micranthus* apparently falls into Sect. *Australes* Jabl., together with *C. stipitatus* (Baill.) Muell. Arg. and *C. Dallachyanus* (Baill.) Benth. Thus composed, this section ranges from Australia to New Caledonia and the Fiji Islands.

Croton Parhamii Croizat, sp. nov.

Frutex innovationibus hispido-pubescentibus, serius glabrescentibus, trichomatibus saepius brunneis pilo centrali porrecto. Foliis elliptico-lanceolatis brunnescentibus, 3–9 cm. longis, 2–4 cm. latis, tenuiter chartaceis, apice sat obtuse acuminatis, basi rotundatis vel rotundato-cuneatis, margine sat obscure crenato-dentatis, supra glabris, subtus trichomatibus saepissime stellatis hispidis in lamina parcius in costa crebre indutis, venis penninerviis arcuato-adscendentibus anastomosantibus ca. 8–12-jugis, primo jugo haud triplinervio; petiolo gracili aeque ac innovationibus induto 0.5–2 cm. longo, glandulis posticis ad basim laminae 2, breviter stipitatis disciformibus.

Inflorescentia subspicata ad 10 cm. longa. Floribus ♂ : pedicello ca. 3–6 mm. longo, perianthio in alabastro subglobuloso, in anthesi latius cyathiformi (ut videtur), ca. 2 mm. longo et 3 mm. lato, petalis cum sepalis subaequilongis, staminibus ca. 10. Floribus ♀ : perianthio extus pubescente late campanulato ca. 3 mm. longo et 5 mm. lato, pedicello 8–10 mm. longo, perianthii lobis ad basim liberis ellipticis, ca. 1 2 mm. longis et 1.5 mm. latis, margine integris, uno alterove interdum subanisomero, petalis glandulisque ut videtur nullis, ovario late ovoideo indumenti copia brunneo-hispidulo, ca. 1.5 mm. magno in stylum evidenter abeunte; stylorum cruribus 3, pro ratione sat crassis, nigris, epapillosis dorso puberulis, ca. 2 mm. longis, fere ad basim 2-partitis, columella fructu delapso gracili ad 5 mm. longa.

Viti Levu: Tholo West: Ridge between Naloka and Naraiyawa, in forest, alt. about 900 m., *B. E. Parham 2464* (A, type), July 26, 1938.

The slightly accrescent ♀ perianth in fruit, with evolute lobes at anthesis, readily distinguishes this new species from *C. heterotrichus* Muell. Arg., which it suggests at first in the pubescence of the lower leaf-surface. *Croton Storckii* (Muell. Arg.) Seem. has a different foliage and ♀ perianth, with a much smaller ovary and scarcely accrescent lobes. *Croton Vercauxii* Baill. is an Australian species, with a ♀ perianth that has characters similar to those of *C. Storckii*. *Croton microtiglium* Burk. is known only from Tonga and suggests the characters of *C. leptopus* Muell. Arg., to judge from the description and an authentic specimen of the latter here available. *Croton Levatii* Guillaumin, of the New Hebrides, is very summarily described (in Bull. Soc. Bot. France 66: 275. 1919), but the remark "sepalis petalisque angustioribus" rules out *C. Parhamii*.

ELAEOCARPACEAE

Elaeocarpus cassinoides A. Gray, Bot. U. S. Expl. Exped. 1: 204. 1854; C. Muell. in Walp. Ann. 4: 331. 1857; Seem. Fl. Vit. 29. 1865; Hemsl. in Jour. Linn. Soc. Bot. 30: 171. 1894.

Vanua Levu: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, type coll.); lower Wainunu River Valley, alt. 0–200 m., *Smith 1735* (GH) (tree 13 m. high, in open forest; native name: *wailoaloa*). Koro: Eastern slope of main ridge, alt. 200–300 m., *Smith 1007* (GH) (spreading tree 23 m. high, in dense forest; trunk 1 m. diam.); western slope, alt. 300 m., *Smith 1086* (GH) (tree 14 m. high, in thickets; petals pale pink).

Elaeocarpus cassinoides has previously been known only from the type collection, a fruiting specimen. Although it was originally reported by Gray from both Fiji and Tonga, its occurrence in the latter group is questionable; Gray remarks, "Those [specimens] from the two localities, as ticketed, are so exactly alike that they might have been taken from the same stem, and, since the habitats are not to be verified from Dr. Pickering's notes, one or the other may be considered doubtful." Mueller, Seemann, and Hemsley, in the publications cited above, repeat Gray's data without citing additional specimens, and it seems that the species has not been re-collected in Tonga. Since the Fijian specimens cited above are obviously conspecific with the type, I believe that the record of this species from Tonga is erroneous. In view of the inadequacy of the original descrip-

tion, I here redescribe the species. Of the cited specimens, *Smith 1007* and *1086* are in flower and the others in fruit.

Tree, up to 23 m. high, the branchlets subterete, slender, brownish, at first pale-puberulent, soon glabrescent; petioles puberulent and glabrescent like the branchlets, slender, canaliculate, 5–15 mm. long; leaf-blades papyraceous or chartaceous, oblong- or obovate-elliptic, 5–10 cm. long, 2–4.5 cm. broad, subacute to attenuate at base, obtuse or obtusely cuspidate at apex, inconspicuously serrulate especially distally (teeth 2 or 3 per centimeter), glabrous on both surfaces or obscurely puberulent on nerves beneath when young, the costa plane or slightly raised above, prominent beneath, the secondary nerves 4–7 per side, erecto-patent, anastomosing, usually prominulous above and slightly raised beneath, the veinlet-reticulation lax, prominulous on both sides or obscure above; racemes axillary, usually 3–4 cm. long at anthesis, 12–17-flowered, short-pedunculate, the rachis and pedicels pale-puberulent, the bracts submembranous, lanceolate, 2–3 mm. long, acute, sparsely puberulent, soon caducous, the pedicels 2–3.5 mm. long at anthesis; sepals 5, submembranaceous, deltoid-oblong, 1.5–2 mm. long, 0.7–1.2 mm. broad, subacute, puberulent on margins, otherwise glabrous, carinate within; petals 5, glabrous, submembranaceous, obovate-cuneate, 1.3–1.7 mm. long, 0.8–1.2 mm. broad, fimbriate with 6–8 lobes, these subequal, obtuse, about 0.3 mm. long; disk 5-lobed, the lobes about 0.4 mm. high and 0.7 mm. broad, each copiously hispidulous and deeply sulcate; stamens 15 or 16, uniseriate, about 3 mm. long, the filaments slender, glabrous, about 0.6 mm. long, the anthers oblong, hispidulous throughout, obtuse, about 0.7 mm. long; ovary and base of style pale-puberulent-hispidulous, the locules 2, each biovulate, the style 0.4–0.5 mm. long, bifid; fruiting inflorescence often shortened by loss of apical portion of rachis, the pedicels stout, 4-5 mm. long, glabrous; fruit glabrous, obovoid, 14–16 mm. long and 8–11 mm. broad at apparent maturity, the pericarp about 3 mm. thick including the rugulose epicarp and the nearly smooth hard endocarp, the locule usually solitary, the dissepiment rarely persistent.

For the time being I am unable to refer *E. cassinoides* to its appropriate section. It is probably related to such New Guinean sections as § *Dactylosphaera* Schlechter and § *Fissipetalum* Schlechter, but it does not entirely agree with either of these. Another Fijian species of this general relationship is *E. kasiensis* A. C. Sm., which was originally referred to § *Dicera*. However, since I have studied the New Guinean species of *Elaeocarpus* and looked into the typification of § *Dicera* (see Jour. Arnold Arb. 25: 223. 1944), I realize that the two Fijian species here discussed should not be placed in § *Dicera*. A study of all the Pacific species is advisable before these can be properly placed. Two other Fijian species possibly of this relationship, both very inadequately known, are *E. laurifolius* A. Gray and *E. pyriformis* A. Gray.

Elaeocarpus (§ *Dicera*) **pittosporoides** sp. nov.

Arbor ad 6 m. alta partibus florum exceptis ubique glabra, ramulis gracilibus teretibus cinereis; foliis apicem ramulorum versus confertis, petiolis leviter canaliculatis gracilibus 1–2 cm. longis, laminis subcoriaceis vel chartaceis in sicco fuscis vel olivaceis, obovato-ellipticis, 6.5–10 cm. longis, 2.5–4.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice

obtuse cuspidatis, margine leviter recurvatis et remote undulato-crenulatis, costa utrinque valde elevata, nervis lateralibus utrinsecus 6–8 erecto-patentibus anastomosantibus et rete venularum laxo utrinque plus minusve prominulis; racemis axillaribus subpendulis ad 6 cm. longis 2–4-floris, pedunculo interdum ad 3 cm. longo et rhachi gracilibus substriatis, bracteis mox caducis, pedicellis gracillimis sub anthesi 2–2.5 cm. longis; sepalis 5 papyraceis vel subcarnosis oblongis, 5.5–6 mm. longis, 1.5–2 mm. latis, subacutis, extus glabris, intus minute puberulis et conspicue carinatis, margine leviter incrassatis; petalis 5 submembranaceis, obovatis, longitudine sepalos aequantibus, 2.5–3 mm. latis, intus basim versus paullo tomentellis ceterum glabris, apice 3–5-lobulatis, lobis 1–2 mm. longis subacutis; disco annulari-pulvinato circiter 0.5 mm. alto obscure 5-lobato superne sparse hispidulo; staminibus 26 vel 27 circiter 3.5 mm. longis 1- vel 2-seriatis ubique minute papilloso-hispidulis, filamentis subteretibus 1–1.5 mm. longis, antheris 2–2.5 mm. longis, apice subacutis erostratis; gynaecio glabro, ovario ovoideo 2-loculari, loculis 4-ovulatis, stylo crasso subulato 2–2.5 mm. longo.

Viti Levu: Namosi: Hills between Navua River and Suva, alt. 200–300 m., *Greenwood 1010* (A, type), May, 1943 (upright tree 5–6 m. high; inflorescences in leaf-axils near apices of branchlets; flower-buds yellow, somewhat dependent on very thin pedicels).

Elaeocarpus pittosporoides appears to have no close relatives among the known Fijian species. I have recently (in Jour. Arnold Arb. 25: 223. 1944) had occasion to discuss the typification of § *Dicera,* to which the new species definitely belongs. In floral characters it is very similar to *E. dentatus* (J. R. & G. Forst.) Vahl, the type of the section, but in foliage and in its slender lax inflorescences it is quite different.

TILIACEAE

Brownlowia sp.

Viti Levu: Lautoka: Mountains near Lautoka, alt. about 550 m., *Greenwood 957* (A) (shrub or small tree); Namosi: Hills between Navua River and Suva, alt. about 250 m., *Greenwood 957A* (A); vicinity of Namuamua, alt. 400 m., *Gillespie 3000* (GH); Rewa: Slopes of Korombamba Mt., alt. 200 m., *Gillespie 2372* (GH).

The cited specimens indicate a substantial extension of the known range of *Brownlowia;* all are sterile, but their place in the genus seems certain, and it is nearly equally certain that they represent an undescribed species. The Fijian specimens are probably of the relationship of *B. argentata* Kurz, as this is represented by material from New Guinea and the Solomon Islands. The occurrence of the genus in the New Hebrides, not previously reported, is indicated by *Kajewski 616* (A) from Vanikoro, a specimen probably referable to *B. argentata.* From this species the Fijian specimens differ in obvious foliage characters, the leaf-blades being longer and with more numerous lateral nerves.

Yuncker (in Bishop Mus. Bull. 178: 80. 1943) has recently reported *Brownlowia* from Niue, also in sterile condition; this record appears to be the easternmost for the genus.

ELATINACEAE

Elatine gratioloides A. Cunn. in Ann. Nat. Hist. 4: 26. 1840; Nied. in E. & P. Nat. Pfl. ed. 2. 21: 276. 1925; Greenwood in Jour. Arnold Arb. 25: 398. 1944.

Elatine americana sensu Hook. f. Fl. Nov. Zel. 1: 27. 1853.
Elatine americana var. *australiensis* Benth. Fl. Austral. 1: 178. 1863; Cheesem. Man. N. Z. Fl. 73. 1906, ed. 2. 568. 1925; F. M. Bailey, Weeds & Pois. Pl. Queensl. 22. *f. 37*. [1907].

VITI LEVU: Lautoka: Mountains near Lautoka, alt. about 600 m., *Greenwood 952* (GH) (entire plant light green; creeping on mud under two inches of slowly running water, in taro plantation).

This species, until Greenwood (l. c.) mentioned it, had previously been reported only from Australia and New Zealand. The collection of a specimen of *Elatine* in Fiji is of especial interest, since, to the best of my knowledge, only one other collection of the genus has previously been cited in literature from the entire Pacific region (other than New Zealand). The earlier collection was *Seemann 183,* from the island of Taveuni, Fiji, which was referred by Seemann (Fl. Vit. 10. 1865) to *E. ambigua* Wight. According to Niedenzu (in E. & P. Nat. Pfl. ed. 2. 21: 276. 1925), *E. ambigua* and *E. gratioloides* are distinct species, the flowers being pedicellate in the former and sessile in the latter. Niedenzu states the range of *E. ambigua* to include Fiji, and I assume that his record is based upon *Seemann 183.* From an examination of a duplicate of this number in the Gray Herbarium, I am inclined to believe that it also represents *E. gratioloides,* since the flowers are usually essentially sessile, only rarely being on short pedicels about 1–2 mm. long. The value of pedicel-length as a specific character may be questioned, since in all other features *Seemann 183* agrees with *Greenwood 952* and the several New Zealand and Australian specimens in the Gray Herbarium. It seems probable to me that the only Fijian species of the genus is *E. gratioloides,* but the difference between this species and *E. ambigua* should be carefully checked.

Bentham, following his original description of *E. americana* var. *australiensis,* states: "This plant, whether a distinct species or a variety of the N. American one, is found also in New Zealand and the Fiji islands, and is very variable." His record from Fiji was doubtless based upon *Seemann 183,* which had been tentatively referred to *E. americana* by A. Gray in Bonplandia 10: 36. 1862.

In the most recent survey of the genus in its entire range, Niedenzu (l. c. 274–276) expresses the opinion that *E. gratioloides* is distinct from both *E. triandra* Schkuhr and *E. americana* (Pursh) Arn. The customary procedure by writers on the flora of Australia and New Zealand is to mention the austral plant as *E. americana* var. *australiensis* Benth. Fassett has recently reduced *E. americana* to varietal rank, as *E. triandra* var. *americana* (Pursh) Fassett (in Rhodora 33: 72. 1931, 41: 373. 1939), but the austral variety is not placed by him. It remains for a monographer to decide what status *E. gratioloides* merits; for the time being I follow Niedenzu in considering it a specific entity. The type was collected by R. Cunningham in 1833, in a bog at Tauraki, Hokianga River, North Island, New Zealand.

FLACOURTIACEAE

Flacourtia vitiensis (Seem.) comb. nov.
Thacombauia vitiensis Seem. Fl. Vit. 426. *pl. 100.* 1873.
Flacourtia ovata Gillespie in Bishop Mus. Bull. 83: 27. *f. 34* (excl. *a, f, g*). 1931.

The monotypic genus *Thacombauia* was originally described by Seemann as a member of the Humiriaceae, but subsequently it was questionably referred to the Euphorbiaceae by Durand, Pax, and Dalla Torre and Harms. A glance at Seemann's plate demonstrates the identity of the plant with *Flacourtia ovata*, which was recently emended by me in Sargentia 1: 61. 1942. While it is regrettable that the name honoring the famous King Thacombau thus falls into synonymy, nevertheless it is a source of satisfaction to place the genus.

MYRTACEAE

Syzygium phaeophyllum Merrill & Perry, nom. nov.

Eugenia durifolia A. C. Sm. in Bishop Mus. Bull. 141: 105. *f. 56*. 1936.

Syzygium durifolium Merrill & Perry in Sargentia 1: 76. 1942, non in Mem. Am. Acad. Arts & Sci. 18: 176. 1939.

Dr. E. H. Walker has called our attention to an oversight in our use of the specific epithet *durifolium* for two different species, the earlier from Borneo and the later from Fiji. Consequently, the Fijian species is here renamed. — E. D. Merrill and L. M. Perry.

MYRSINACEAE

Tapeinosperma Greenwoodii sp. nov.

Arbor ad 5 m. alta ubique partibus juvenilibus et inflorescentiis puberulis exceptis glabra, ramulis subteretibus rugulosis cinereis apicem versus 3–6 mm. crassis; foliis apicem ramulorum versus aggregatis, petiolis angulatis supra complanatis crassis (1.5–2 mm. diametro) 5–8 mm. longis, laminis chartaceis juventute copiose pellucido-punctatis mox opacis in sicco fusco-olivaceis elliptico-oblongis vel obovatis, 12–16 cm. longis, 5–8 cm. latis, basi gradatim angustatis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine saepe undulatis et paullo recurvatis, costa supra leviter canaliculata subtus prominente, nervis lateralibus primariis utrinsecus 15–20 cum aliis debilioribus interspersis patentibus rectis marginem versus anastomosantibus utrinque valde prominulis, rete venularum intricato utrinque paullo prominulo; inflorescentiis axillaribus multifloris trivel quadripinnatim paniculatis, 12–20 cm. longis, 6–14 cm. latis, pedunculo 4–6 cm. longo et rhachi ramulisque gracilibus dense brunneo-glanduloso-puberulis; bracteis deltoideo-oblongis circiter 1.1 × 0.7 mm. subacutis utrinque puberulis et margine ciliatis; pedicellis teretibus gracilibus 0.8–1 mm. longis puberulis; calyce rotato-cupuliformi circiter 2.5 mm. diametro, basi rotundato, extus parce glanduloso-puberulo, intus glabro, lobis 5 fere ad basim liberis late ovatis, circiter 0.8 × 1.1 mm., margine minute glanduloso-ciliolatis, apice emarginatis vel interdum rotundatis; corolla (paullo ante anthesin) circiter 3 mm. longa, lobis fere ad basim liberis ovatis 2–2.5 mm. latis, apice acutis, superne leviter punctatis; staminibus prope basim corollae insertis subsessilibus, antheris elongato-deltoideis circiter 1 × 0.8 mm. saepe glandulas 2 vel 3 dorso gerentibus; gynaecio sub anthesi circiter 1.6 mm. longo, ovario ovoideo in stylum gracilem circiter 1 mm. longum attenuato, stigmate minuto subpeltato, placenta ovoidea 2-ovulata.

Viti Levu: Lautoka: Mt. Evans, alt. about 900 m., *Greenwood 944* (A, type), Oct. 25, 1942 (small tree 3–5 m. high, the inflorescences lax, dependent).

Tapeinosperma Greenwoodii is most closely allied to *T. clavatum* Mez, with which it has in common short petioles, elliptic leaf-blades of moderate size and with prominulous venation, and ciliate and usually emarginate calyx-lobes. However, the new species has a much more ample and more complex inflorescence, the pedicel is slender and not conspicuously swollen distally into a conical calyx like that of *T. clavatum,* and the flowers are smaller throughout. The calycine character seems dependable, as the several specimens of *T. clavatum* examined have the calyx as described by Gillespie (in Bishop Mus. Bull. 74: 9. *f. 8.* 1930). The new species may also be compared with *T. Hornei* Mez, a species with long-petiolate large leaves, a shorter, simpler, and lepidote inflorescence, and larger flowers with acute or acuminate calyx-lobes.

RUBIACEAE

Mussaenda L.

Although it has been customary to refer the Pacific representatives of *Mussaenda* to *M. frondosa* L., examination of specimens and literature indicates that this is erroneous. Students of the Pacific floras have apparently been aware of this fact, but no alternative identification has been seriously suggested for the common Pacific plant, which is, in some areas, one of the most abundant elements of second growth vegetation. However, a species supposedly endemic to Raiatea, *M. raiateensis* J. W. Moore, was described in 1933. A careful examination of abundant Pacific material of the genus, including an isotype of *M. raiateensis* (for the loan of which I am greatly indebted to Dr. Moore, of the University of Minnesota), inclines me to believe that a single species occurs from the New Hebrides to the Society Islands, to which Moore's binomial may be applied. A discussion of the relationships of this Pacific species and an emended description follow.

The Linnaean species, *M. frondosa* (Sp. Pl. 177. 1753), is based upon several earlier references, among them Linnaeus' Flora Zeylanica (p. 35. 1747) and Burman's Thesaurus Zeylanicus (p. 165, *tab. 76.* 1737). The actual type is a collection of Hermann from Ceylon. The Ceylon plant described in the above references, and further amplified by Trimen (Handbook Fl. Ceylon 2: 323. 1894), is a scrambling shrub, with the branchlets, leaves, and the enlarged calyx-lobe densely and closely velutinous-tomentose. A representative specimen from Ceylon is *J. M. de Silva 38* (A).

The actual geographical range of *M. frondosa* is in doubt, but its occurrence in the eastern Malaysian and the Pacific regions is highly questionable. In their recent work on the genus in Papuasia (in Jour. Arnold Arb. 25: 192–196. 1944), Merrill and Perry did not find the species represented in the available material. The true *M. frondosa,* as represented by specimens from Ceylon and India, differs from the Pacific entity not only in its habit and its generally more obvious pubescence, but also in its longer normal calyx-lobes (5–10 mm. long), in its anthers being more deeply inserted on the corolla-tube (tips of anthers 4–9 mm. below apex of tube), and in its fruit being elenticellate or essentially so.

A closer relative of the Pacific plant than *M. frondosa* is *M. philippica* A. Rich., of the Philippine and Solomon Islands. In common with the Pacific entity, Richard's species differs from *M. frondosa* in its more highly placed stamens and its lenticellate fruits. From *M. philippica*, the Pacific plant differs in its longer and more or less subulate, rather than deltoid-lanceolate, calyx-lobes, and in its comparatively thick pericarp, which, when mature, remains firm and does not readily break. Another species of the Solomon Islands, *M. Kajewskii* Merr. & Perry (in Jour. Arnold Arb. 25: 194. 1944), is very close to *M. philippica* and differs from the Pacific plant in the same characters pertaining to comparatively short calyx-lobes.

The common *Mussaenda* of Micronesia has been mentioned in the literature as *M. frondosa* L. (Volkens in Bot. Jahrb. 31: 475. 1901; Safford in Contr. U. S. Nat. Herb. 9: 330. 1905; Merr. in Philip. Jour. Sci. Bot. 9: 147. 1914; Fosberg in Occ. Pap. Bishop Mus. 15: 215. 1940) and *M. sericea* Bl. (Valeton in Bot. Jahrb. 63: 300. 1930; Kanehira in Bot. Mag. Tokyo 45: 351. 1931, Fl. Micrones. 369. 1933, in Jour. Dept. Agr. Kyushu Univ. 4: 421. 1935). This Micronesian *Mussaenda* is certainly not *M. frondosa* in the limited sense of Ceylon and Indian plants, and its identity with *M. sericea*, based on a Moluccan specimen, is open to doubt. However, I see no reason to exclude the Micronesian specimens now available to me (*Kanehira 90, 1157, 1177, 1993, Herre 12* [all NY]) from *M. philippica* A. Rich. At any rate, these Micronesian plants differ from those of the more southerly islands (New Hebrides to Societies) in the characters above discussed for *M. philippica*.

Another species of *Mussaenda* occurring in the Pacific region is *M. cylindrocarpa* Burck, found in the New Hebrides (Guillaumin in Jour. Arnold Arb. 13: 4. 1932) but apparently not extending farther east into the Pacific. This species is characterized by having its stamens deeply inserted on the corolla-tube and its fruit cylindric, and it is not concerned in a discussion of the identity of the species which is so abundant in Fiji, Samoa, and eastward.

To summarize, it seems obvious that the common *Mussaenda* which extends from the New Hebrides to Rarotonga is amply distinct from *M. frondosa* L. and that its closest allies are more probably *M. philippica* A. Rich. and *M. Kajewskii* Merr. & Perry. This entity does not appear separable from *M. raiateensis* J. W. Moore, although it is a fairly variable species, in which subspecific divisions may eventually seem desirable. For the time being I cannot tie up the slight morphological variations, such as those pertaining to the degree of pubescence, with geographical regions. The following description is based on all material of the species now available to me.

Mussaenda raiateensis J. W. Moore in Bishop Mus. Bull. 102: 44. 1933.

Mussaenda frondosa sensu Forst. f. Fl. Ins. Austr. Prodr. 17. 1786; A. Rich. Sert. Astrolab. 2: ix. 1834; Endl. in Ann. Wien. Mus. Naturgesch. 1: 175. 1836; Guillemin in Ann. Sci. Nat. Bot. II. 7: 251. 1837; Seem. in Jour. Bot. 2: 72. 1864, Fl. Vit. 123. 1866; Powell in Jour. Bot. 6: 370. 1868; Engl. in Bot. Jahrb. 7: 477, pro parte. 1886, Forschungsr. Gazelle Siphon. 46, pro parte. 1889; Drake, Ill. Fl.

Ins. Mar. Pac. 189. 1890; Hemsl. in Jour. Linn. Soc. Bot. 30: 180. 1894; Reinecke in Bot. Jahrb. 25: 690. 1898; Burkill in Jour. Linn. Soc. Bot. 35: 40. 1901; Cheesem. in Trans. Linn. Soc. Bot. II. 6: 282. 1903; Gibbs in Jour. Linn. Soc. Bot. 39: 151. 1909; Wilder in Bishop Mus. Bull. 86: 102. 1931; Guillaumin in Jour. Arnold Arb. 13: 4. 1932; Fosberg in Bull. Torr. Bot. Club 67: 420. 1940; non L.

?Mussaenda formosa sensu Seem. Fl. Vit. 123, as synonym. 1866 (forsan quoad Forst. Icon. ined. *t. 56, 57*), non Jacq.

Mussaenda frondosa var. *pilosissima* sensu Reinecke in Bot. Jahrb. 25: 690. 1898; Rechinger in Denkschr. Akad. Wiss. Wien 85: 368. 1910 (repr. 3: 194); Setchell in Carn. Inst. Publ. 341: 43. 1924; non Engl.

Mussaenda sp. Christoph. in Bishop Mus. Bull. 128: 199. 1935.

Shrub or slender tree 2–10 m. high, sometimes said to be epiphytic or subscandent, the branchlets slightly flattened when young, densely hispidulous with pale or brownish hairs 0.3–0.5 mm. long, at length terete, glabrescent, brownish, striate, gray-lenticellate; stipules interpetiolar, 7–17 mm. long, deeply bifid, sericeous toward base, sparsely hispidulous distally, soon caducous, each lobe subulate-lanceolate; petioles slender, subterete or shallowly canaliculate, 5–25 (–40) mm. long, densely hispidulous to glabrescent like the branchlets; leaf-blades papyraceous, olivaceous or brownish when dried, often slightly paler beneath, ovate or oblong-elliptic, 10–18(–20) cm. long and 5–10(–14) cm. broad (uppermost leaves sometimes smaller), acute to attenuate (rarely subrounded or obtuse) at base and decurrent on the petiole, gradually acuminate at apex (acumen 5–30 mm. long), entire or lightly undulate at margin, sparsely hispidulous (often densely so on veins) and often soon glabrescent above, more densely hispidulous beneath (especially on nerves and in axils, the hairs pale, spreading, 0.5–1 mm. long) but at length often essentially glabrescent, the costa nearly plane or raised above, prominent beneath, the secondary nerves 7–10(–12) per side, ascending, curved or nearly straight, prominulous above, strongly elevated beneath, the veinlet-reticulation copious, plane or faintly impressed on both sides; inflorescence terminal, several- to many-flowered, often wide-spreading at maturity and up to 12 cm. long and broad but usually much smaller, the branches and pedicels hispidulous like the petioles or puberulent, essentially glabrous in fruit, the pedicels slender, short, up to 5 mm. long or essentially none, the bracts (up to 6 mm. long) and the minute bracteoles linear-subulate and soon caducous; calyx-tube oblong-cylindric or turbinate, at anthesis 3–5 mm. long, hispidulous or sericeous with pale or brown hairs 0.1–0.5 mm. long, the lobes 5, erect, linear-subulate, 4–6.5 mm. long, hispidulous, glabrescent within and distally, one lobe often enlarged; enlarged calyx-lobe membranaceous, white or yellowish, ovate or ovate-lanceolate, 5–8(–10.5) cm. long, 2.5–6.5 cm. broad, attenuate to obtuse at base and contracted into a slender stipe 5–20 mm. long, short-acuminate or cuspidate at apex, sparsely hispidulous on both sides or glabrescent, several-nerved from base, the veinlet-reticulation often obvious; disk annular, glabrous; corolla slenderly infundibular, pale yellow proximally, yellow or orange distally, 23–40 mm. long including lobes, the tube hispidulous or sericeous (often inconspicuously so) without, glabrous or subglabrous within toward base and distally (above attachment of anthers) copiously and densely soft-strigose with pale ascending hairs about 1 mm. long, the lobes 5, spreading, oblong or ovate-deltoid, 3–6.5 mm. long and broad, cuspidate at apex, usually puberulent without and copiously glandular-

puberulent within; stamens 5, glabrous, inserted in throat of corolla (tip of anthers 1–3 mm. below apex of corolla-tube), the filaments very short, the anthers linear, 3.5–5.5 mm. long, acute at apex, sagittate at base; style filiform, glabrous, equaling or slightly exceeding the corolla-tube, bifid for about 1.5 mm. at apex; fruit ellipsoid or turbinate, glabrous at maturity, green when fresh, brownish or blackish when dried, 10–15 mm. long, 7–11 mm. broad, truncate at apex, obtuse at base and contracted into a slender stipe 2–4 mm. long, the calyx-lobes caducous or the enlarged one sometimes subpersistent, the pericarp firm, copiously marked with large gray elliptic lenticels, the seeds minute, black, reticulate.

DISTRIBUTION: New Hebrides, Fiji, Samoa, Tonga, Rarotonga, and Society Islands; probably also in some of the adjacent groups. Reported from a variety of habitats, including clearings, thickets, open forest, and occasionally rain-forest; in Fiji it is one of the commonest plants in second growth thickets and is rarely absent from this habitat. Reported altitudes range from sea-level to 900 m. The type is *Moore 684* from Raiatea.

NEW HEBRIDES: ANEITYUM: *Milne* (NY); Anelgauhat Bay, *Kajewski 922* (A, NY). FIJI: VITI LEVU: Lautoka: Mountains near Lautoka, *Greenwood 164* (A); Tholo North: Nandarivatu, *Degener & Ordonez 13526* (A, NY), *Reay 9* (A); Sovutawambu, near Nandarivatu, *Degener 14602* (A, NY); Naitasiri: Vicinity of Nasinu, *Gillespie 3555* (NY); Waindina River basin, *MacDaniels 1053* (A). KANDAVU: Namalata Isthmus region, *Smith 25* (GH, NY). VANUA LEVU: Thakaundrove: Hills south of Nakula Valley, *Smith 330* (GH, NY); Valanga, Savu Savu Bay, *Degener & Ordonez 13987* (A, NY); summit of Uluinabathi Mt., Savu Savu Bay region, *Degener & Ordonez 13936* (A, NY); Maravu, near Salt Lake, *Degener & Ordonez 14185* (A). TAVEUNI: Vicinity of Wairiki, *Gillespie 4754* (NY). OVALAU: Vicinity of Levuka, *Gillespie 4471* (NY), *Degener & Ordonez 13795* (A, NY). MAKONDRONGA: *Degener & Ordonez 13814* (A, NY). KORO: Eastern slope of main ridge, *Smith 1030* (NY). ONEATA: *U. S. Expl. Exped.* (NY). FULANGA: *Smith 1173* (NY). Fiji, without other locality: *U. S. Expl. Exped.* (GH, NY), *Seemann 238* (GH), *Horne* (GH), *Prince* (GH). SAMOA: SAVAII: Vaipouli, *Vaupel 355* (NY); Salailua, *Christophersen 2999* (NY). UPOLU: Near Malololelei, *Christophersen 323* (NY). TAU: Fitiuta trail back of Luma, *Garber 610* (NY). Samoa, without other locality: *U. S. Expl. Exped.* (GH). TONGA: TONGATABU: Along the Hala Loto, *Setchell & Parks 15490* (GH). EUA: Western edge of the Plateau, *Parks 16200* (A, GH, NY). COOK ISLANDS: RAROTONGA: *Parks & Parks 22209* (GH). SOCIETY ISLANDS: RAIATEA: West side of highest mountain, March 24, 1927, *Moore 684* (TYPE COLL., herb. Univ. Minnesota).

COMMON NAMES (and sources): In Fiji: *Mbovu* or *Mbovo* (all collectors), *Vakatharendavui* (Smith), *Vombo* (Reay); in Samoa: *Uto'uto, Ma'osina* (Powell), *Fua i tausaga, Laupaepae* (Setchell), *Alo alo vao, Fue* (Christophersen); in Rarotonga: *Kotuku* (Cheeseman, Wilder).

NATIVE USES: In Fiji decoctions of the leaves and bark are commonly used as a cure for fever, chest complaints, and kidney diseases.

Airosperma

Airosperma Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 565. 1901.

Abramsia Gillespie in Bishop Mus. Bull. 91: 27. 1932.

Dr. L. M. Perry has kindly pointed out to me the apparent similarity of *Airosperma* (with four species endemic to New Guinea) and *Abramsia* (monotypic and supposedly endemic to Fiji). Careful examination of the literature and the available specimens indicates that these two generic con-

cepts are essentially identical. We thus have another illustration of a genus extending from New Guinea to Fiji, presumably to be anticipated in the intervening island groups, from which it has not yet been reported.

In their original discussion of *Airosperma,* Lauterbach and K. Schumann place the genus in the "Albertinae," pointing out its essential characters of pendulous solitary ovules and contorted corolla-lobes. In the classification of K. Schumann (in E. & P. Nat. Pfl. IV. 4: 16. 1891), this appears to be correct, and *Airosperma* may be placed in the Coffeoideae-Guettardinae-Alberteae (op. cit. 87–89). This is the position assigned to the genus by Krause (in E. & P. Nat. Pfl. Nachtr. 3: 328. 1908).

Gillespie, in placing his new genus *Abramsia,* expresses a belief that its relationships are in the Ixoreae; the pendulous ovules, however, would seem to exclude consideration of this or any other division of the Psychotriinae. Gillespie emphasizes precisely the same combination of characters which differentiates *Airosperma,* and indeed his illustration (op. cit. *fig. 31*) shows that the fundamental characters of *Abramsia* are similar to those of *Airosperma* (illustrated in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee *t. 21.* 1901).

Although the specific epithets originally associated with *Airosperma* were *psychotrioides* and *ramuensis,* and although subsequent discussions have treated the generic name as feminine, it must be considered neuter, according to Art. 72 (2) of the International Rules of Botanical Nomenclature (1935).

Airosperma trichotomum (Gillespie) comb. nov.

Abramsia trichotoma Gillespie in Bishop Mus. Bull. 91: 29. *fig. 31.* 1932; Fosberg in Bull. Torrey Bot. Club 67: 422. 1940, in Sargentia 1: 125. 1942.

Airosperma trichotomum is known from several collections from the Fijian islands of Viti Levu, Vanua Levu, and Taveuni, which are cited in the listed publications. The available material shows that the species is fairly variable as to leaf-size, but in important respects it is reasonably consistent.

Although linear calyx-lobes characterize *Airosperma psychotrioides* (the illustrated New Guinean species), other species of the genus, notably *A. grandifolium* Val., have the calyx-lobes more or less deltoid. In the Fijian species the calyx-lobes are still smaller, but this character is hardly of generic value. Gillespie's species is also marked by its large thin leaves and comparatively ample inflorescences.

Mastixiodendron

Mastixiodendron Melchior in Bot. Jahrb. 60: 167. 1925.

Dorisia Gillespie in Hook. Ic. Pl. 32: *pl. 3190.* 1933.

Mastixiodendron and *Dorisia* were both originally described as members of the Cornaceae allied to *Mastixia* Bl. Gillespie's genus was transferred to the Rubiaceae by the present writer in 1936 (in Bishop Mus. Bull. 141: 140) and was referred to the tribe Chiococceae, but at that time *Mastixiodendron* was insufficiently known to me to be carefully considered. More recently Merrill and Perry (in Jour. Arnold Arb. 23: 416. 1942) have

also removed *Mastixiodendron* from the Cornaceae to the Rubiaceae,[1] commenting on its close relationship to *Dorisia*. Further examination of the two specific entities involved demonstrates that the differences between them are scarcely generic in nature. Those differences pointed out by Gillespie deal merely with the comparative length and position on the fruit of the calyx-tube and appear to be of specific value only.

In order to have the reduction of *Dorisia* to *Mastixiodendron* verified, ample material of the two species involved — *Dorisia flavida* (Seem.) A. C. Sm. from Fiji and *Mastixiodendron pachycladon* [*"pachyclados"*] (K. Schum.) Melchior from New Guinea — was submitted to Dr. Charlotte G. Nast for study. Her report states that: *"Dorisia* and *Mastixiodendron* could be taken as congeneric. Their nodal anatomy (trilacunar), stomata (the usual rubiaceous type), wood, and pollen are similar. The wood has oblique-porous vessels, septate fibers, no wood parenchyma, and fairly short heterogeneous rays. The tricolpate pollen grain has a fairly fine but distinctly reticulate exine. *Mastixia* Bl. is not related to *Mastixiodendron.* The wood of the two genera is entirely different, that of *Mastixia* having scalariform vessels with many bars, diffuse-aggregate parenchyma, and very long heterogeneous rays. The stomata of *Mastixia* are not of the rubiaceous type, and the tricolpate pollen grain is very finely reticulate, almost granular in appearance, the pores being smaller and the grooves larger than those of the pollen grain of *Mastixiodendron."*

In view of this evidence, and because of the lack of differentiating taxonomic characters, it appears that *Dorisia* may be incorporated in the older genus. *Mastixiodendron,* as thus amplified, has a range extending from Halmahera (see Merrill and Perry in Jour. Arnold Arb. 25: 205. 1944) through New Guinea to Fiji. Its discovery in the Solomons and New Hebrides is to be anticipated and would complete a very natural geographical distribution.

Mastixiodendron flavidum (Seem.) comb. nov.
Canthium flavidum Seem. Fl. Vit. 132. 1866.
Plectronia flavida Benth. & Hook. f. ex Drake, Fl. Ins. Mar. Pac. 194. 1890.
Dorisia rarissima Gillespie in Hook. Ic. Pl. 32: *pl. 3190.* 1933.
Dorisia flavida A. C. Sm. in Bishop Mus. Bull. 141: 140. 1936; Fosberg in Sargentia 1: 120. 1942.

This species is known from the Fijian islands of Vanua Levu, Rambi, and Viti Levu, as mentioned in the above-cited publications. Gillespie mentions *Horne 1132,* and Fosberg *Parham III,* as pubescent-leaved individuals possibly worthy of nomenclatural recognition. These two specimens, both in fruit, appear to the present writer to represent an undescribed species.

Mastixiodendron pilosum sp. nov.

Arbor, ramulis leviter angulatis demum subteretibus cinereisque, apicem versus copiose puberulis; stipulis rigidis oblongo-lanceolatis 18–25 mm. longis inconspicue puberulis mox caducis; petiolis subteretibus vel leviter canaliculatis robustis (1–2 mm. diametro) 2–4 cm. longis dense puberulis;

[1] Apparently *Mastixiodendron* was first referred to the Rubiaceae by Danser (in Blumea 1: 69. 1934), in his study of the Cornaceae of the Netherlands Indies.

laminis chartaceis in sicco fuscis subtus pallidioribus oblongo-ellipticis, 12–22 cm. longis, 6–9.5 cm. latis, basi acutis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine integris paullo recurvatis, supra glabris subnitidis, subtus pilis pallidis patulis 0.1–0.4 mm. longis conspicue et persistenter molliter pilosis, costa conspicua supra subplana vel leviter canaliculata subtus prominente, nervis secundariis utrinsecus 7–10 patentibus marginem versus curvatis et laxe anastomosantibus supra paullo subtus valde elevatis, rete venularum intricato utrinque prominulo; inflorescentiis thyrsoideis axillaribus ad 15 cm. longis pauciramosis, pedunculo longo ramulisque copiose pallido-puberulis, bracteis parvis mox caducis, pedicellis sub fructu gracilibus 2–4 mm. longis puberulis, bracteolis lanceolatis circiter 1 mm. longis inconspicuis subtentis; calyce post anthesim turbinato ut pedicello puberulo, limbo brevi persistente, lobis 4 vel 5 deltoideis acutis ad 1 mm. longis; corolla non visa; fructibus oblongo-ellipsoideis, ad 20 × 7 mm., basi et apice obtusis, praeter calycis lobos glabris, calycis limbo subnullo, lobis 4 vel 5 inconspicuis membranaceis late deltoideis minute hirtellis infra fructus apicem 2–3 mm. orientibus, pericarpio circiter 1 mm. crasso, exocarpio carnoso, mesocarpio tenui fibroso, endocarpio duro, loculis seminibusque 1 vel 2, seminibus oblongo-ellipsoideis ad 13 mm. longis et 2 mm. latis utrinque obtusis, testa conspicue reticulato-incrassata, albumine copioso albo.

VANUA LEVU: Mbua: Between Mbua and Ndevoka, *Mrs. H. B. R. Parham III* (A) (tree near creek; fruits orange). Fiji, without definite locality: *Horne 1132* (GH, TYPE). The Horne collection, the better of the two listed, was probably also obtained on Vanua Levu, from which the bulk of his collection came.

The leaves of *M. flavidum* (Seem.) A. C. Sm. are entirely glabrous beneath or very minutely puberulent on the costa and principal nerves, whereas those of the new species are densely, conspicuously, and persistently soft-pilose beneath with pale spreading hairs. The young branchlets, stipules, inflorescence-branches, fruiting pedicels, mature calyces, and persistent calyx-lobes of *M. pilosum* are similarly pubescent, the corresponding parts in *M. flavidum* being glabrous. These differences appear to be of specific value, and I doubt if such a well-defined species as *M. flavidum* should be interpreted to include the pubescent form here described as new.

Both of the Fijian species differ from the New Guinean *M. pachycladon* in their less robust habit, longer and more slender petioles, narrower leaf-blades, and more nearly completely inferior fruits.

COMPOSITAE

Erigeron sumatrensis Retz. Obs. Bot. 5: 28. 1789.

VITI LEVU: *Parks s. n.* (Bish); Tholo North: Nandarivatu, on open slopes, *Parks 20623* (Bish).

This widespread weed, often recorded under the later binomial of *E. linifolius* Willd. (1804), has been reported from only Hawaii and Easter Island in the Pacific region.

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NOTES ON SOME CHINESE AND KOREAN SPECIES OF THALICTRUM

Bernard Boivin

With one plate

Recent collections in China made under the auspices of the Arnold Arboretum have resulted in the assembling of about 200 specimens of *Thalictrum*, mostly from Yunnan; these are now deposited in the Gray Herbarium. The purpose of the present paper is to present descriptions of certain new species found among this material and to discuss other noteworthy species. When this work was first undertaken, in October, 1943, there was a nearly complete lack of material for comparison in the Harvard herbaria, and I was forced to depend upon the original descriptions in making identifications. Since then, however, at Dr. Merrill's request, Sir William Wright Smith, of the Royal Botanic Garden at Edinburgh, has very kindly sent us thirteen packets containing authentic fragments of as many of Léveillé's species. Each packet is fully annotated and contains fairly large fragments, so carefully selected that no trouble was experienced in identifying them, except, of course, when the plants had been badly preserved or collected too early.

I am deeply indebted to Sir William Wright Smith for his generosity in sending these fragments, and also to the authorities of the Arnold Arboretum and the Gray Herbarium for the specimens and facilities placed at my disposal. All cited specimens, unless otherwise stated, are deposited in the Gray Herbarium.

Subgenus **Thalictrum** (DC.) Reichenb.

§ **Homothalictrum** Boivin

Thalictrum Esquirolii H. Lév. & Vaniot in Bull. Acad. Int. Géogr. Bot. 17(210–211): ii. 1907.

Part of the type material, consisting of a complete plant and an inflorescence, is in the Gray Herbarium; this is very good material in full bloom. Most of the herbarium specimens which I have seen identified as this species have been correctly named.

Thalictrum minus L. var. **elatum** Lecoyer in Bull. Soc. Bot. Belg. 24: 202. 1885.

Thalictrum amplissimum H. Lév. & Vaniot in Bull. Acad. Int. Géogr. Bot. 11: 51. 1902.

Thalictrum minus var. *amplissimum* H. Lév. & Vaniot ex H. Lév. Fl. Kouy-Tchéou 339. 1915.

A fragment of a syntype of *T. amplissimum* is preserved in the Gray Herbarium. This is a side branch of the inflorescence of a plant 2 feet high, collected in flowering condition. Whether the actual type is at Edinburgh

or at the Académie Internationale de Géographie Botanique is not known, nor whether the original material is made up of two different collections or a single collection.

§ Leptostigma Boivin

Thalictrum acteaefolium Sieb. & Zucc. var. **clematidifolium** (Franch.) Finet & Gagnep. in Bull. Soc. Bot. France 50: 611. 1903.

The variety, known from Szechuan and Yunnan, is pubescent throughout and its anthers are about 1 mm. long, while the typical form is entirely glabrous and has anthers about 1.5 mm. long. Specimens of the typical form are at hand from Japan, Korea, Kiangsi, and Chekiang.

Thalictrum Atriplex Finet & Gagnep. in Bull. Soc. Bot. France 50: 613. *pl. 19, B.* 1903.

This species is closely related to *T. baicalense* Turcz., and it is probable that the latter should be placed in § *Leptostigma* rather than in § *Physocarpum*. Indeed, *T. baicalense* is a more or less heterodox species.

Thalictrum cirrhosum H. Lév. in Rep. Nov. Sp. 7: 97. 1909.

A fragment of an isotype, preserved in the Gray Herbarium, proves to be altogether different from any other specimen at hand. The whole plant is pubescent except upon the upper surface of the leaves. All the hairs are simple and short except those on the lower surfaces of the leaves, these bearing numerous short branches and having stellate tips. This is a unique type of pubescence in *Thalictrum*. The specific epithet *cirrhosum* is undoubtedly wrong, for the type has no cirrhi, nor have any other specimens of the genus. But the Edinburgh isotype is labeled "*cirrosum*" in Léveillé's hand. This could be the adjectival form of "cirrus" and could well be used to describe a plant having the habit of *T. trichopus* Franch. or *T. cincinnatum* Boivin. However, as the fragment looks much more like *T. deciternatum* Boivin than like any other species, one is at a loss to understand Léveillé's choice of a specific epithet.

Thalictrum deciternatum sp. nov. PL. I, FIGS. 4–7.

Planta omnino glabra, sed foliolis inferne interdum pubescentibus, caule, ramis, petiolis petiolulisque pruinosis, 50–125 cm. alta, radicibus fibrosis, haud stolonifera. Folia basilaria aetate florendi desunt. Folia caulinaria 10–30 cm. longa, sessilia in apice dilatationis petiolaris vel breviter petiolata, 6–10-ternata. Stipellae desunt. Foliola 3–10 mm. longa, bi-trilobata, crassa, margine revoluto, superne dense viridia et nervis paullo impressis, inferne glauca et nervis rugosis valde reticulatis. Foliolum terminale basi cuneatum apice rotundo-truncatum, mucronatum. Inflorescentia paniculata ramosa copiosa paullulum foliosa. Pedicelli sub receptaculo recurvati. Sepala elliptica lutea ca. 4 mm. longa. Filamenta lutea filiformia ca. 5 mm. longa. Antherae oblongo-lineares 3–3.5 mm. longae, mucrone 0.1–0.3 mm. longo. Ovaria subsessilia 4–5. Stigma sessile 1–1.5 mm. longum anguste bialatum a sepalis recedit. Carpella immatura compressa subsessilia, ventre basi cuneato, summo rotundo, nervo ventrali quam dorsali paullulum convexiore. Floret junio julio et augusto.

YUNNAN: Ad lat. or. mont. niveor. prope Lichiang, in dumetis, ad 1.25 m., alt. ca. 3200 m., junio 16, 1914, *C. Schneider 1805* (TYPE); Lichiang Snow Range, common along mountain stream, August 27, 1937, *T. T. Yü 15480;* eastern slopes of Likiang

Snow Range, gulch leading to main peak, among rocks, fls. yellow, May 24, 1922, *J. F. Rock 3801;* Likiang Snow Range, open pasture, plant 3 ft. high, fls. green-yellow, June 25, 1939, *R. C. Ching 30272;* Li-kiang Hsien, grassy slope under forest, fls. greenish white, alt. 3000 m., July 1935, *C. W. Wang 70955;* Wei-si Hsien, Yeh-chih, mountain slope, fls. yellow, alt. 3600 m., Aug. 1935, *C. W. Wang 68341;* Chi-ling Shan, Cheng-kiang, fls. light purple, alt. 1960 m., Aug. 25, 1939, *H. Wang 41681;* without detailed data, *T. T. Yü 9891, 12008.*

Thalictrum Delavayi Franch. in Bull. Soc. Bot. France 33: 367. 1886.
?Thalictrum grandisepalum H. Lév. in Bull. Acad. Int. Géogr. Bot. 11: 297. 1902.
?Thalictrum Duclouxii H. Lév. in Rep. Nov. Sp. 7: 98. 1909.

Thalictrum grandisepalum recalls *T. Delavayi* in its flowers, but it might possibly be a different species. The type fragment at hand shows a plant collected too early in bloom and very poorly preserved. A fragment of a syntype of *T. Duclouxii* is also at hand, but this was collected when the flowers were still in bud. Consequently, it is impossible to identify with certainty either of Léveillé's species listed above.

Thalictrum Finetii sp. nov. PL. I, FIGS. 1–3.

Planta 50–200 cm. alta, foliolis inferne et fructibus dense pubescentibus, caule et petiolis puberulis. Pubescentia caulinaris fructuum et petiolorum e pilis capitatis translucidis minutis, foliorum opacis minutis crassiusculis. Radices fibrosae, nec planta stolonifera. Caulis et rami flexuosi. Folium basilarium deest aetate florendi. Folia caulinaria regulariter 4-ternata et fere omnia sessilia in apice dilatationis petiolaris. Petioluli arcuantes. Stipellae desunt. Foliola membranacea ovata 5–15 mm. longa, trilobata lobis crenatis. Inflorescentiae variabiles, aliae reductae, aliae amplae. Pedicelli sub receptaculo recurvati et fere omnes ex axillis foliorum 1–3-ternatorum. Sepala 4–5, elliptica, 3.5–4.5 mm. longa. Filamenta filiformia pallide lutea ca. 6 mm. longa. Antherae oblongo-lanceolatae ca. 2.5 mm. longae, acumine ca. 1 mm. longo. Ovaria 7–10. Stigma 0.9–1.2 mm. longum haud alatum sed ventrale. Carpella matura laminaria, divaricata, stipite ca. 0.4 mm. longo, ventre semi-obovato ca. 4 mm. longo et 1.5 mm. lato, nervo dorsali recto, ventrali convexo et alis angustis undulatis munito. Floret julio et augusto.

SZECHUAN: Mt. Omei, hillside, fls. white, alt. 2200 m., Aug. 1, 1938, *K. N. Yin 117* (TYPE); Mt. Omei, shrubby flat, 3 ft. high, fls. white, alt. 3300 m., July-Aug. 1931, *F. T. Wang 23458;* Lieng-ho-kou, grassland, fls. yellow, alt. 12000 ft., Aug. 1938, *T. S. Wen 563.* YUNNAN: Mekong-Salween Divide, rocky places in mountains, casual, 15–20 inches high, fls. yellow, alt. 4000 m., Aug. 11, 1938, *T. T. Yü 22298;* Chengkang, Snow Range, common on grassy slope, 2–3 ft. high, fls. white, alt. 3460 m., July 24, 1938, *T. T. Yü 16930;* A-tun-tze, ravine, July-Aug. 1935, *C. W. Wang 64790;* Che-tse-lo, Pi-lo Shan, fls. yellow, alt. 4000 m., Aug. 18, 1934, *H. T. Tsai 58014;* Litiping, between Likiang and Weihsi, in mixed forests, 3–5 ft. high, Oct. 9, 1939, *R. C. Ching 22072;* Wei-si Hsien, Yeh-chih, common on mountain slope, alt. 3200 m., July 1935, *C. W. Wang 68033;* north flank of Haba Snow Range, open pasture, 3 ft. high, fls. white, Aug. 20, 1939, *K. M. Feng 2100;* Ta-li Hsien, on open slope, 3 ft. high, fls. white, alt. 3500 m., July 30, 1933, *H. T. Tsai 53943;* without detailed data, *T. T. Yü 6915.*

This species is dedicated to the botanist A. Finet, who published, in collaboration with A. Gagnepain, a very good treatise on the eastern Asiatic species of *Thalictrum.* The nearest relative of *T. Finetii* is *T. platycarpum* Hook. f. & Thoms., of which a syntype is at hand. However, the new species is much larger throughout, with longer anthers and with a narrower

fruit, which has less prominent ribs, a shorter stipe, and a well defined style.

Thalictrum Smithii sp. nov. PL. I, FIGS. 20–22.

Planta 40–150 cm. alta, plus minusve pubescens vel fere glabra, radicibus fibrosis in locis tuberosis, tuberibus ovoideis. Folia caulinaria ca. 5-ternata. Stipellae desunt. Foliola membranacea ovata crenata, (0.5–)1(–1.5) cm. longa. Inflorescentia ampla paniculata ramosa ramis flexuosis et fere nudis. Pedicelli brevissimi (3–)5(–15) mm. longi recti. Sepala elliptica dorso puberula ca. 2.5 mm. longa. Filamenta filiformia ca. 4 mm. longa. Antherae oblongo-lineares, ca. 2.5 mm. longae, apice obtusae. Ovaria 4–5. Stigma ventrale subsessile haud alatum, 0.7–1 mm. longum. Carpella matura haud compressa costata sessilia, ventre obovoideo 1.2–1.6 mm. longo et 0.8–1.2 mm. lato, nervis gibbosulis. Floret septembri.

SIKANG: Muli, Wachin, Shawan, common on margin of thickets, 1–2 ft. high, achenes black, alt. 3000 m., Oct. 11, 1937, *T. T. Yü 14487* (TYPE). YUNNAN: Chetse-lo, in forest, fls. yellow, alt. 3200 m., Sept. 7, 1934, *H. T. Tsai 58383;* Shang-pa Hsien, on open slope, 5 ft. high, fls. yellowish, alt. 1500 m., Sept. 27, 1933, *H. T. Tsai 54683;* without detailed data, *H. T. Tsai 57289.*

This new species is dedicated to Sir William Wright Smith.

Thalictrum samariferum sp. nov. PL. I, FIGS. 31, 32.

Planta omnino glabra 10–45 cm. alta. Radices fibrosae, interdum in locis paullulum tuberosis. Stolones desunt. Folia ab internodiis superantur, 5–6-ternata et sessilia in apice dilatationis petiolaris. Foliola coriacea, margine revoluta, minora, ca. 3 mm. longa, basi cuneata, apice trifida vel saepius (1–)3(–5)-lobata. Stipulae adnatae integrae lanceolatae. Stipellae desunt. Inflorescentia interdum simplex, saepius plus minusve ramosa, semper foliosa. Pedunculi fere omnes ex axillis foliorum 2–5-ternatorum. Pedicelli recurvati, vel, si recti, sub receptaculo valde reflexi. Flores 5–25. Carpella matura ca. 10 in receptaculo. Stigma paullulum alatum 1–1.2 mm. longum et sessile. Stipes carpelli maturi 3–7 mm. longus haud alatus nisi prope ventre. Venter carpelli maturi 5–7 mm. longus et 4–5 mm. latus, obcordatus et laminaris bialatus, alis regularibus, alia ventrali convexa, altera dorsali convexiore, et ambae 0.5–2 mm. latae et membranaceae. Nervi carpelli maturi quatuor, quorum unus ventralis, unus dorsalis et duo laterales, omnes vero paullulum rugosi. Flores mihi ignotae sunt.

YUNNAN: A-tun-tze, mountain slope, fruit greenish white, alt. 2700 m., Sept. 1935, *C. W. Wang 70156* (TYPE); A-tun-tze, border of woods, fruit green, alt. 3000 m., July-Aug. 1935, *C. W. Wang 64885, 64772;* without detailed data, *T. T. Yü 12993.* Southeastern TIBET: Sacred mountain Kar-war-kar-boo, Tsa-wa-rung, on bare rocks at foot of mountain, fruit light brown, alt. 3500 m., Sept. 1935, *C. W. Wang 66468;* Djermai, Tsa-wa-rung, alt. 3200 m., Aug. 1935, *C. W. Wang 65720;* Gerda, Ree-su-la, Tsa-wa-rung, on grassy slope, fruit purple, alt. 3600 m., Aug. 1935, *C. W. Wang 65913.*

In habit this species closely resembles *T. elegans* Wall., but it has a much larger fruit, a usually simpler and more leafy inflorescence with longer pedicels, and is always glabrous. Another specimen from Yunnan, *T. T. Yü 6236,* collected early in bloom, may also belong here.

Thalictrum trichopus Franch. in Bull. Soc. Bot. France 33: 370. 1886.
Thalictrum Tenii H. Lév. in Rep. Nov. Sp. 7: 98. 1909.

A fragment of an isotype of *T. Tenii* is preserved in the Gray Herbarium.

Thalictrum virgatum Hook. f. & Thoms. Fl. Ind. 1: 14. 1855. PL. I, FIGS. 25–27.
Thalictrum virgatum var. *stipitatum* Franch. in Bull. Soc. Bot. France 33: 369. 1886.
Thalictrum verticillatum H. Lév. in Rep. Nov. Sp. 7: 97, 99. 1909.

Léveillé's reduction of his own *T. verticillatum* to *T. virgatum* is correct, judging from part of the type material of the former and an isotype of the latter preserved in the Gray Herbarium. Franchet's var. *stipitatum* is the typical form of this species. Lecoyer's drawing (in Bull. Soc. Bot. Belg. 24: *pl. 4, fig. 10.* 1885) does not represent *T. virgatum.*

Thalictrum Yui sp. nov. PL. I, FIGS. 23, 24.

Species *Thalictro deciternato* nostro aspectu multo consimilis. Differt pubescentia totius plantae e pilis capitatis translucidis composita, nisi in foliolis inferne pilis crassiusculis et opacis. Ovaria conspicue stipitata. Stigma ca. 1 mm. longum. Carpella matura compressa subcostata, stipite 1.3–2.3 mm. longo, ventre 2.2–2.8 mm. longo et 1.5–1.7 mm. lato, nervo dorsali paullulum convexo, ventrali multo convexiore quam dorsali.

SIKANG: Muli, Kulu, rocky places in thickets, casual, 2–3 ft. high, achenes pale brown, alt. 3300 m., Sept. 14, 1937, *T. T. Yü 14273* (TYPE).

§ Erythrandra Boivin

Thalictrum javanicum Bl. Bijdr. Fl. Ned. Ind. 2. 1825.
Thalictrum Argyi H. Lév. in Bull. Herb. Boiss. II. 6: 504. 1906.

A fragment of an isotype of *T. Argyi* is preserved in the Gray Herbarium.

Thalictrum ramosum sp. nov. PL. I, FIGS. 12–15.

Planta diffusa e basi ramosa viridula glabra debilis, 25–40 cm. alta. Folia basilaria adsunt, triternata, 20–30 cm. longa. Stipellae desunt. Foliola membranacea, (1–)1.5(–2) cm. longa, saepius obovata et apice crenata, nervis inferne rugosulis. Flores subcorymbosi. Sepala orbicularia 2–2.2 mm. longa. Filamenta alba clavata 1.5–2.2 mm. longa. Antherae ellipsoideae, ca. 0.7 mm. longae, apice rotundae. Ovaria staminibus parum longiora, 8–12. Stigma ventrale haud alatum ca. 0.3 mm. longum. Stylus cum stigmate ca. 0.5 mm. longus. Carpella matura brunnea sessilia fusiformia haud compressa nec costata, ventre lanceolato ca. 4.5 mm. longo et 1.2 mm. lato, nervo ventrali paullum convexiore quam dorsali. In eadem planta nonnunquam et flores et carpella matura inveniuntur quia flores ad anthesim veniunt in successione a mense aprili.

SZECHUAN: South of Kuan Hsien, along ditch, fls. reddish, alt. 850–950 m., Apr. 14, 1930, *F. T. Wang 20378* (TYPE); Mt. Omei, under shady rocks, fls. greenish white, alt. 900 m., Apr. 15, 1932, *T. T. Yü 274;* Chengtu, Mar. 15, 1937, *S. S. Chien 5880.*

Thalictrum Rockii sp. nov. PL. I, FIGS. 28–30.

Planta 1.5 m. alta, omnino pubescens nisi in caule inferiore e pilis uniseriatis translucidis aetate florendi, aetate maturandi glabra nisi in foliolis inferne pubescentia crassiuscula opaca praedita. Folia caulinaria 4–5-ternata estipellata, foliolis 0.8–1.5 cm. longis, trilobatis, lobis saepius crenatis. Inflorescentia copiosa ramosissima paniculata. Sepala ovata ca. 3 mm. longa. Filamenta clavata 5.5–7.5 mm. longa. Antherae oblongo-lanceolatae ca. 1 mm. longae. Ovaria ca. 4, ventre compresso breviore quam stipite, stigmate ca. 0.5 mm. longo breviore quam stylo libero. Carpella matura pendula haud costata laminaria, stipite tenui 3–3.5 mm. longo,

ventre semi-obovato 5–5.5 mm. longo, 2.8–3.2 mm. lato, nervo ventrali multo convexiore quam dorsali. Floret junio julioque.

KANSU: Upper Tebbu (T'ieh-pu) country, below Shihmen, Tsaluku valley, in forests of spruces, willows, etc., fls. creamy white, alt. 11000 ft., July-Aug. 1925, *J. F. Rock 13054* (TYPE); T'ao River basin, valley of Tayüku, grassy slopes, fls. greenish, alt. 8500 ft., July 1925, *J. F. Rock 12835*. TSINGHAI (Ch'ing-hai): Ba valley, under willows, fls. greenish yellow, alt. 9900 ft., June 23, 1926, *J. F. Rock 14271*.

In the herbarium of the New York Botanical Garden there is a fruiting specimen of this species, collected by W. Y. Hsia (no. *2400*) at Ling-shan-kou in Cho-lu Hsien.

Thalictrum Wangii sp. nov. PL. I, FIGS. 8–11.

Planta 30–40 cm. alta, omnino dense pubescens pilis capitatis translucidis. Folia caulinaria 3-ternata, ea inflorescentiae 1–2-ternata. Stipulae semi-ovatae ca. 1 mm. longae. Stipellae desunt. Foliola membrancaea ca. 8 mm. longa, fere orbicularia, apice trilobata, lobis crenatis. Inflorescentia 4–8-flora. Pedicelli 1–2 cm. longi, sub receptaculo plus minusve recurvati, omnes ex axillis foliorum 1–2-ternatorum. Flores albi. Sepala elliptica ca. 5 mm. longa. Filamenta alba apice clavata ca. 4.5 mm. longa. Antherae oblongo-lineares, albae, ca. 1.5 mm. longae, apice rotundatae. Ovaria fusiformia 4–6. Stylus cum stigmate ca. 1.8 mm. longus. Stigma anguste bialatum ca. 0.6 mm. longum. Carpella matura ignota. Floret julio.

YUNNAN: Li-kiang Hsien, in woods, fls. yellowish white, alt. 2700 m., July 1935, *C. W. Wang 71546* (TYPE). Southeastern TIBET: Dzer-nar, Tsa-wa-rung, dry slope on border of woods, alt. 3000 m., Sept. 1935, *C. W. Wang 66523*.

The closest relative of this species seems to be *T. Fargesii* Franch.

§ Physocarpum DC.

Thalictrum coreanum H. Lév. in Bull. Acad. Int. Géogr. Bot. 11: 297. 1902.

In my recently published monographic study of *Thalictrum*, I expressed doubt (in Rhodora 46: 368. 1944) as to whether *T. coreanum* and *T. ichangense* Lecoyer (ex Oliv. in Hook. Ic. Pl. 18: *t. 1765*. 1888) were distinct species. At the time this original paper was prepared, we had very good and abundant material of the latter but only one poor specimen of the former. At present, the situation is reversed, and I have available very good fragments of *T. coreanum* but only one poor specimen of *T. ichangense*. From the material at hand, and from my recollection of that which I have previously examined, these two species are undoubtedly distinct. *Thalictrum coreanum* has a compact subcorymbose inflorescence and a fruit which is sessile or nearly so, with a body about three times longer than broad. Its leaflets are orbicular, 9 in number to each basal leaf, and very leathery at maturity. *Thalictrum ichangense* has a somewhat diffuse inflorescence with the flowers more or less racemose on the branches. Its fruit is conspicuously stipitate, with a body about five times longer than broad. The leaflets of its basal leaves are more or less triangular, with a rounded base, and usually are 3 or 5, or very rarely 9, per leaf. At maturity the leaflets are firm, strongly bicolored, and always dull beneath. *Thalictrum coreanum* has a much stouter appearance throughout.

Thalictrum tuberiferum Maxim. in Bull. Acad. Sci. St. Pétersb. 22: 227. 1876.
Thalictrum Fauriei H. Lév. in Rep. Nov. Sp. 7: 100. 1909; nec. H. Lév. & Vaniot in Bull. Soc. Bot. France 53: 388. 1906; nec Hayata in Jour. Coll. Sci. Tokyo 22: 7. 1906.
Thalictrum punctatum H. Lév. in Rep. Sp. Nov. 10: 376. 1912.

Fragments of the type of *T. Fauriei* H. Lév. and of the syntype of *T. punctatum* are available; both apparently belong to *T. tuberiferum* Maxim.

§ Tripetrium DC.

Thalictrum aquilegifolium L. Sp. Pl. 547. 1753.
Thalictrum Taqueti H. Lév. in Rep. Nov. Sp. 7: 339 (nec 100). 1909.
Thalictrum Dunnianum H. Lév. in Rep. Sp. Nov. 8: 549. 1910.

Fragments of type material of Léveillé's species are available in the Gray Herbarium. *Thalictrum Dunnianum* is merely a renaming of the *T. Taqueti* based on *Taquet 508*, this specific epithet having been used twice by Léveillé.

Subgenus **Lecoyerium** Boivin

§ **Cincinneria** Boivin

Thalictrum Mairei H. Lév. in Rep. Nov. Sp. 7: 339. 1909. PL. I, FIGS. 16–19.

Planta robusta omnino glabra 50–150 cm. alta. Folia basilaria petiolata, petiolo basi valde dilatato. Folia caulinaria 4–5-ternata petiolo brevi. Stipulae membranaceae semi-orbiculares. Stipellae membranaceae semi-orbiculares 1–3 cm. latae, ad ramificationes petioli fere omnes adsunt. Foliola ca. 1 cm. longa, membranacea. Inflorescentia paniculata valde ramosa et foliosa. Pedicelli robusti 1–3 cm. longi, sub receptaculo paullo incurvati, fere omnes ex axillis foliorum 2–3-ternatorum. Sepala fere orbicularia 4. Ovaria ca. 10. Stigma conspicue bialatum lanceolatum sepala excedens, ca. 3 mm. longum et 0.5–1 mm. latum. Carpella matura costata fere haud compressa, valde reflexa, stipite crasso ca. 1 mm. longo, ventre lanceolato 6–7.5 mm. longo et 1.8–2 mm. lato. Stigma persistens circinatum. Floret maio et julio.

SZECHUAN: Inter Oti et Ouentin, in dumetis, fl. roseo-lilacini, alt. ca. 2500 m., junio 3, 1914, *C. Schneider 1170;* inter Kuali et Molien, planta ad 1 m., alt. ca. 3200 m., majo 25, 1914, *C. Schneider 1382.* SIKANG: Muli, Kulu, Tungyehtze, under thickets, casual, 3–5 ft. high, achenes pale brown, alt. 3100 m., Sept. 22, 1937, *T. T. Yü 14335.* YUNNAN: N. W. Likiang, Ah-nar-koo, near Shikoo, in open pasture, fls. canary, June 1, 1939, *R. C. Ching 20652;* Likiang Snow Range, on open hillside, fls. yellow, June 14, 1939, *R. C. Ching 30228;* eastern slopes of Likiang Snow Range, Pai-shui Ho, fls. dull dark purple, May 17, 1922, *J. F. Rock 3572;* without detailed data, *T. T. Yü 5706, 11686.*

This species evidently belongs to the Section *Cincinneria*, along with *T. macrostigma* Finet & Gagnep. The closest relative of these two species is *T. macrocarpum* Gren., from the French Pyrénées. At first I took the species described above to be new, but, through a fragment received from Edinburgh, I was able to ascertain its identity with *T. Mairei.* However, the above description, based on the cited specimens, does not seem superfluous.

EXPLANATION OF THE PLATE

All drawings are × 6 except Fig. 4, which is × 2, and Fig. 19, which is × 1.

FIGS. 1–3. *Thalictrum Finetii* Boivin: stamen and ovary, *Yin 117;* fruit, *Ching 22072.* FIGS. 4–7. *Thalictrum deciternatum* Boivin: contour of a terminal leaflet, ovary, immature fruit, and stamen, *Schneider 1805.* FIGS. 8–11. *Thalictrum Wangii* Boivin: sepal, stamen, ovary, and young fruit, *Wang 71546.* FIGS. 12–15. *Thalictrum ramosum* Boivin: stamen, sepal, and ovary, *Wang 20378;* fruit, *Yü 274.* FIGS. 16–19. *Thalictrum Mairei* H. Lév.: ovary and stamen, *Ching 20652;* single fruit and head of fruits, *Yü 14335.* FIGS. 20–22. *Thalictrum Smithii* Boivin: ovary and stamen, *Tsai 54683;* fruit, *Yü 14487.* FIGS. 23, 24. *Thalictrum Yui* Boivin: ovary and fruit, *Yü 14273.* FIGS. 25–27. *Thalictrum virgatum* Hook. f. & Thoms.: stamen and ovary, *J. D. Hooker,* Sikkim; fruit, *Yü 14544.* FIGS. 28–30. *Thalictrum Rockii* Boivin: fruit, *Hsia 2400;* stamen and ovary, *Rock 13054.* FIGS. 31, 32. *Thalictrum samariferum* Boivin: ovary and fruit, *Wang 70156.*

GRAY HERBARIUM,
HARVARD UNIVERSITY.

Chinese and Korean Species of Thalictrum

FURTHER NOTES ON THE FLORA OF INDO-CHINA[1]

Hui-Lin Li

This brief article supplements a previous paper (Jour. Arnold Arb. 24: 362–374. 1943), and in it three new species and two new varieties are described, one new name is proposed, and four previously described species are for the first time recorded from Indo-China. The genera *Bredia* and *Stapfiophyton* are new to that country. The types of the new forms herein described are deposited in the herbarium of the Arnold Arboretum.

ELAEOCARPACEAE

Elaeocarpus hainanensis Oliv. in Hook. Ic. Pl. 25: *t. 2462.* 1896.

Elaeocarpus linearifolius Knuth, Repert. Sp. Nov. 49: 66. 1940, syn. nov.

Indo-China: Annam, Tourane and vicinity, *J. & M. S. Clemens 3484* (isotype of *E. linearifolius*), May-June, 1927, shrub or small tree, river-margin, flowers dull yellow.

This Indo-Chinese plant, described by Knuth as *E. linearifolius,* is manifestly the same as the Hainan species. This is one of the many species common to both regions.

THEACEAE

Cleyera japonica Thunberg var. **tonkinensis** var. nov.

A typo speciei differt foliis obovatis, 4–6 cm. longis, 2.5–3.5 cm. latis, obtusis, fructibus longe pedicellatis, pedicellis ad 3 cm. longis.

Indo-China: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan and vicinity, *W. T. Tsang 26987* (type), Oct. 16–22, 1936, *29371,* July 14–31, 1939, a small tree 20 ft. high, fairly common in thickets, fruits yellow or black.

Among the different varieties of the species as treated by Kobuski (Jour. Arnold Arb. 18: 118–129. 1937), this new variety is nearest var. *Morii* (Yamamoto) Masamune, but it may be readily distinguished by the smaller leaves with obtuse apices and by the much longer fruiting pedicels.

FLACOURTIACEAE

Hydnocarpus annamica sp. nov.

Arbor 8–10 m. alta, ramulis teretibus puberulis vel subglabris; foliis chartaceis oblongo-ellipticis, 10–14 cm. longis, 3.5–4.5 cm. latis, longe acuminatis (acumine 2–2.5 cm. longo), basi acutis, margine integris, supra in sicco atro-brunneis, glabris, subtus pallidioribus parce puberulis, venis lateralibus utrinsecus 6 vel 7, supra distinctis, subtus elevatis, valde arcuatim adscendentibus, rete venularum utrinque subconspicuo; petiolo 1–2 cm. longo, puberulo vel glabrescente; floribus ignotis; fructu axillari solitario oblongo-ovoideo, circiter 3 cm. longo et 2 cm. lato, dense fulvo-

[1] Prepared with partial support of a grant from the Penrose Fund, American Philosophical Society, to Dr. E. D. Merrill, to assist him in working up the accumulated collections of Chinese and Indo-Chinese botanical material in the herbarium of the Arnold Arboretum.

velutino, pericarpio 0.5 mm. crasso, semine solitario, ovoideo, circiter 1.5 cm. longo et 1.3 cm. lato; pedicello 7 mm. longo, crasso.

INDO-CHINA: Annam, 12 kilometers north of Dankia, Lang-Biang, *E. Poilane 18660* (TYPE), Jan. 13, 1931, a tree 8–10 m. high, on slightly rocky argillaceous soil, in forests, alt. 1200–1500 m.; the fruit has a strong odor.

In the absence of flowers, the species cannot be placed in the proper section of the genus. It is strongly characterized by the one-celled, one-seeded fruit. Prof. I. W. Bailey, who examined the structure of the wood, reports that in all respects it is that of a *Hydnocarpus*.

MELASTOMATACEAE

Bredia violacea sp. nov.

Frutex parvus, ramis teretibus hirsutis; foliis in paribus aequalibus, subchartaceis, oblongo-ovatis, circiter 9–10 cm. longis, 5.5–6 cm. latis, acuminatis, basi distincte cordatis, 7-nerviis, margine hirsutis, supra sparse setosis, subtus leviter puberulis, venis venulisque supra subconspicuis, subtus distinctis; petiolis circiter 5 cm. longis, sparse hirsutis; inflorescentiis terminalibus cymoso-paniculatis, circiter 15 cm. longis, leviter puberulis et sparse longe hirsutis, pilis saepissime glandulosis, pedunculis 8–9 cm. longis, pedicellis circiter 1 cm. longis, violaceis, bracteolis minutis, vix 1 mm. longis; calycis tubo 5 mm. longo, lobis 4, late triangulari-ovatis, 3 mm. longis, 3.5 mm. latis, acutis vel subrotundatis, leviter puberulis et sparse longe hirsutis, in sicco distincte violaceis; petalis 4, membranaceis, oblongo-ovatis, 7–8 cm. longis, 4–5 cm. latis, late acutis, in sicco superne albidis, inferne violaceis; staminibus 8 aequalibus, filamentis glabris, circiter 6 mm. longis, antheris linearibus, leviter curvatis, olivaceis, circiter 8 mm. longis, longe acuminatis, connectivo sub theca antice tuberculato, postice breviter calcarato, stylo circiter 1.1 cm. longo, olivaceo.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30751* (TYPE), Oct. 13-Nov. 22, 1940.

In general appearance, this species closely resembles *Bredia tuberculata* (Guillaumin) Diels, but it differs, among other characters, in its cymose-paniculate instead of umbellate inflorescences. In the inflorescence character, it belongs to the group of *Bredia hirsuta* Blume. The new species is characterized by its broad distinctly violet calyx-lobes and its large violet anthers. The genus is new to Indo-China.

Stapfiophyton peperomiaefolium (Oliv.) Li, Jour. Arnold Arb. 25: 29. 1944.
Sonerila peperomiaefolia Oliv. in Hook. Ic. Pl. 19: *t. 1814*. 1889.
Gymnagathis peperomiaefolia Stapf, Ann. Bot. 6: 315. 1892.

INDO-CHINA: Tonkin, Ha-Coi, Taai Wong Mo Shan, Chan Uk Village near Chuk-phai, *W. T. Tsang 29029*, May 1–10, 1939, an herb, fairly common in thickets, in dry sandy soil, fruit brown. The species has previously been known only from Kwangtung.

This is an acaulescent plant which closely matches the syntype (*C. Ford 336*, photo. in herb. New York Botanical Garden), except that the leaves are somewhat broader and less acute. The Indo-Chinese specimen is in fruit, while the type is from a flowering plant.

Blastus membranifolius sp. nov. § *Desmoblastus*

Frutex, ramis junioribus minute subalbide tomentellis; foliis inaequalibus

vel aequalibus, tenuiter membranaceis, longe petiolatis, oblongis, 10–12 cm. longis, 3.5–6 cm. latis, longe acuminatis, basi subrotundatis vel rotundatis, utrinque et margine setulosis, nervis primariis 3 marginalibus duobus gracilioribus additis, venis transversalibus supra inconspicuis, subtus prominentibus; petiolo 1.5–7 cm. longo, subalbide tomentello; floribus axillaribus, solitariis vel 2- vel 3-fasciculatis, pedunculis circiter 7 mm. longis, tomentellis; calycibus obconico-quadrangularibus, extus tomentellis, 1.5 mm. longis, lobis brevibus; petalis rhomboideis, 2–3 mm. longis; staminibus 4, filamentis 2–3 mm. longis, antheris 1.5–2 mm. longis, apice rotundatis, connectivo sub theca calloso.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30112* (TYPE), May 18-July 5, 1940.

The new species is allied to *Blastus tenuifolius* Diels and *B. setulosus* Diels, differing from both in the leaves being setulose on both surfaces and in the longer pedicels.

Memecylon nigrescens Hook. & Arn. Bot. Beechey Voy. 186. 1833; Merr. Lingnan Sci. Jour. 13: 65. 1934.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30643,* Oct. 13-Nov. 22, 1940. Kwangtung, Hainan; new to Indo-China.

Memecylon ligustrifolium Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Miscel. 4: 117. 1852.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26950,* Oct. 1–8, 1936, a shrub 10 ft. high, fairly common in thickets, in dry sandy soil, fruits black; Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30361,* July 18-Sept. 9, 1940; Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30654,* Oct. 13-Nov. 22, 1940. Kwangtung, Kwangsi; new to Indo-China.

Memecylon coacerviflorum nom. nov.

Memecylon confertiflorum Merr. Jour. Arnold Arb. 19: 58. 1938, non Cogn. 1891.

INDO-CHINA: Southern Annam.

VERBENACEAE

Tsoongia axillariflora Merr. var. **trifoliolata** var. nov.

A typo speciei differt foliis plerumque trifoliolatis.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30135* (TYPE), May 18-July 5, 1940. KWANGTUNG: Shih Wan Tai Shan, Foo Lung, *H. Y. Liang 69710,* July 16, 1937, shrubby, scandent, in open forests, flowers yellow.

Callicarpa formosana Rolfe, Jour. Bot. 20: 358. 1882.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, Shuei Mei Village, *W. T. Tsang 29378,* July 14–31, 1939, a shrub 7 ft. high, fairly common, growing in clayey soil among scattered shrubs, flowers lavender; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29947,* May 18-July 5, 1940. Formosa, the Philippines, eastern and southern China; new to Indo-China.

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